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PRINCETON'S SESQUICENTENNIAL.

American students rejoice in common in the 150th anniversary of the University of Princeton, formerly known as the College of New Jersey. Although Princeton does not, in the European sense, completely fulfill the definition of the term university, inasmuch as it lacks several departments which the latter comprises—and which are considered as necessary in order to make up the curriculum of a broad seat of learning—yet there are few institutions in the United States more worthy to bear the name and at the same time do it greater honor. Many of its graduates have passed through its doors to attain both a national and international reputation, and even though a State institution Princeton has aimed toward being a national rather than a local seat of education. The celebration which ended on Thursday, Oct. 22, a brief account of which is given by Dr. Hale in another column of this issue, will pass into history as one of the most memorable of its kind and one which was a fitting commemoration to the institution which bears the distinction of having been the home of Joseph Henry. American institutions now undoubtedly stand in the front rank in the field of medicine, and promise to attain within comparatively few years a leading position in the field of the natural sciences also, a fact now generally being recognized by American students and indicated by the rapidly diminishing percentage in the number who go to foreign shores to complete their education.

COMPRESSED AIR VS. ELECTRIC POWER ON STREET RAILWAYS.

Evidences of internal dissensions in the Board of Directors of the Metropolitan Traction Company, of New York, over the question of the relative merits of the electric and compressed-air systems of propulsion have reached the public ear within the past few weeks, and during the last few days the growing differences culminated in a practical outbreak of hostilities. Viewing the situation in the light of the facts that can be gleaned at this time, it is evident that a battle is impending which may mean the death of either the compressed-air system or the underground trolley system of propulsion, in New York City at least. The absolute merits of the systems, however, seem to figure less in the contention than does the question of personal interest. Two opposing factions have sprung up in the board. One favors the use of compressed air as the motive power for the propulsion of the company's cars and the other favors electric power, and which will ultimately come out victorious in the fight remains to be seen—the practicability of the two systems being apparently a question of secondary importance. The compressed-air advocates are represented by Mr. William C. Whitney, while the cause of electricity is championed by Mr. John D. Crimmins. Mr. Crimmins states that in his opinion the electric system as now operated on the company's Lenox Avenue branch is much superior in efficiency to the compressed-air system, and decidedly so as compared with the cable system. Mr. Crimmins some time since sent an expert to Paris to examine and study compressed-air traction in that city, and his report was unfavorable to the system. It is hinted that the interests involved in this fight are deeper than appear on the surface, and that it is essentially a contention between one of the large electrical manufacturing companies and the new air power industry for supremacy in the New York City railway field. It has been stated, and is apparently the general opinion, that the underground electric system was laid down on the Lenox Avenue line for the purpose of discrediting it and killing it, and if, as reported, the air-power party in the Board of Directors is the more powerful, there would seem to be some color of truth in the belief.

THE AMERICAN STREET RAILWAY ASSOCIATION CONVENTION.

The fifteenth annual convention of the American Street Railway Association proved to be the most successful in the history of this growing and most important organization. The success is not to be attributed so much to the papers which were presented as to the active interest taken by those in attendance in the discussion of street railway problems and to the splendid exhibits of the manufacturers and electrical supply dealers. Perhaps the most interesting paper read was that by Mr. Richard McCulloch on the "Modern Power House," which will be published in a subsequent issue. In the discussion which followed, Mr. Arnold brought out several points relating to the use of batteries in connection with a combined lighting and power load, which alone for the novelty of the ideas presented will attract the attention of all interested in this problem. As will be noted in Mr. Arnold's remarks, he over-compounds for the lighting load only, the power load being carried by the batteries placed in parallel with the shunt field winding. This method, however, apparently does not obviate excessive fluctuations at the lamps during the more than ordinary demands made upon the generators by the elevator service, while the percentage of fluctuation is to our knowledge as large as at least in one plant in which both elevators and lights are carried on the same generators, but without the use of batteries. From the standpoint of fluctuation at the lamps Mr. Arnold's arrangement appears to offer therefore no material advantage, the advantage lying in the fact that the engines are always loaded to their most economical operating point. Mr. Bowen's paper on "Track and Track Joints, Construction, Maintenance and Bonding" called forth considerable discussion, in which was developed several points of value to street-railway engineers, not the least important being the question of bonding. A method of bonding which combines both mechanical and electrical features is one which is sure to find favor, but it still seems to remain an open question whether cast iron can be made to form with a steel rail a union having a conductivity as high as that of bonds of other familiar types. The difficulty lies in preventing the formation of an oxide coating between the rail and cast iron, and until this defect is eliminated it appears, according to the discussion on Mr. Bowen's paper, that additional bonding is desirable. From a mechanical standpoint the cast-welded bond is apparently meeting with greater favor than the electrically welded joint which, aside from the first cost, offers practically the same advantages. The resolution adopted to the effect that a union of the American Street Railway Association and the National Electric Light Association was not called for will doubtless result to the best interests of both associations. Every one who attended the Convention was so well pleased with the reception tendered the delegates that it now involves a difficult task on the part of those having in charge the arrangements for the Niagara meeting to excel that held last week in St. Louis.

THE INSULATION RESISTANCE OF A STREET RAILWAY CABLE.

In another column will be found a communication from Mr. Charles Hewitt on "The Insulation Resistance of a Street Railway Cable," in which is described an extremely simple and practical method of making such measurements in an ordinary electric railway power-station. The means employed is simply to connect the insulation resistance in series with a voltmeter across a low potential, and knowing the resistance of the voltmeter, from its indicated deflection the insulation resistance may be readily calculated. Assuming the potential constant, Mr. Hewitt takes the deflection, which is say 550 volts. This deflection is proportional to the current flowing in the instrument. If on reconnecting the latter in series with the insulation resistance any other deflection is obtained, it is evident that the combined resistance of the system must be greater in inverse ratio to the two deflections, and subtracting the volt meter resistance, the insulation resistance is at once obtained. It may be said, however, that in making such measurements it is important that the voltage does not vary, otherwise the results will be erroneous. In fact it would be better to take the voltage at the bus-bar terminals with one voltmeter, and take simultaneous readings with a testing voltmeter. If only one voltmeter is at hand, a special arrangement of switches should be provided to instantly shift the connections. The method suggested of locating a fault is quite accurate, and if properly applied is sure to find the difficulty with precision and despatch, but it involves the cutting of the cable in one or more places and the subsequent annoyance of making joints. Inasmuch as the cable is entirely disconnected from the system and therefore is not used, it would be better to send through it a strong current independently of the loaded machines. Let the lineman take with him a low-reading voltmeter, and selecting a place, measure off a definite length of cable, being careful that this length includes no joints. The insulation may be pierced by pins thus making contact with the metallic core at selected points, and assuming the resistance of the cable to be a certain amount, the voltmeter deflection is proportional to the current flowing in the cable. By repeating the experiment in other places the point will soon be found where the current is notably less than before. It will then be evident that the leakage occurs between the last two points tested, and by gradually approaching from either direction in much the same way as in Mr. Hewitt's method, the fault may be located without cutting the cable, an important consideration. Of course, it is necessary for the attendant at the station to keep the current on the cable absolutely constant, and for the lineman to measure off exactly equal lengths of cable in making his tests, at the same time securing good contacts where the insulation is pierced. Due care must also be taken to note any change in the size or the type of cable, so that these factors can be taken into account in making the measurements. The high resistance instrument mentioned by Mr. Hewitt is an extremely convenient accessory in any testing equipment, and it is surprising that it is not possessed by more having occasion for its use. With such an arrangement an actual voltmeter containing the moving parts can be made to deflect with a very small voltage and thus be useful in such tests as have just been alluded to The resistances to be measured can be subdivided into multiple parts, so that the instrument may be used with accuracy over a wide range of voltages.

The American Institute of Electrical Engineers.

The 109th meeting of the American Institute of Electrical Engineers was held on Wednesday evening last, Oct. 21, President Duncan occupying the chair. There were about 100 members and guests present. The meeting was devoted to a topical discussion of electrical traction under steam railway conditions, and was opened by Dr. Charles E. Emery. Communications were read from Charles K. Stearns and Charles H. Davis. In the discussion which was then taken up the following-named gentlemen participated: H. Ward Leonard, George S. Strong, A. E. Kennelly, C. F. Uebelacker, E. E. Ries, George L. Colgate and F. W. Darlington.

At the meeting of the Executive Committee held during the afternoon three associate members were elected and three were transferred to membership.

The Berliner Telephone Suit.

A despatch from Washington states that the Supreme Court on Oct. 19 gave permission to the Standard Telephone Company to file a brief in the suit of the United States against the American Bell Telephone Company. Chief Justice Fuller, of the United States Supreme Court, has announced that the hearing in the Bell telephone case, involving the validity of the Berliner patent, which was set for last Friday, has been postponed until Nov. 9.

On the Measurement of the Insulation Resistance of Street Railway Cables.

BY CHAS. HEWITT.

My attention has been called to an article by Messrs. Houston and Kennelly on "Testing Railway Feeder Cables," and published in THE ELECTRICAL WORLD of Aug. 8. It escaped my notice at the time, but after reading it I feel prompted to describe a method of testing which I instituted almost two years ago for the Electric Traction Company of Philadelphia.

I can emphasize very emphatically all the difficulties which Messrs. Houston and Kennelly have described in attempting to use any form of Thompson or D'Arsonval reflecting galvanometer, and I might add some additional troubles which I have experienced which they do not refer to.

Messrs. Houston and Kennelly refer to the induction from adjoining cables; this is a very fruitful source of trouble and error, and practically reduces all such testing to the merest guesswork. On several occasions the galvanometer showed that the current was actually coming in over the cable, as the spot of light reflected in a direction contrary to what it should. Several times I also found the battery had been injured, and was somewhat puzzled to account for it. The battery used was of the silver chloride type, containing 100 cells; on examination, however, the cause became apparent. The following diagram, Fig. 1, shows the method of connections for making this test.

It will be noted that as soon as the battery key is closed, if the cable is already grounded, it becomes an auxiliary to the system of return cables, and I have known the current to actually flow back through the grounded cable and through the battery, when only a few cells were in service. After experiencing these difficulties a few times I began to look around for something better, and although the method adopted was new to me, and so far as I was aware at the time was not in use at any other place, yet by reason of its simplicity I do not suppose it is entirely novel.

The method consists in simply replacing the D'Arsonval reflecting galvanometer by a Weston voltmeter, and using the bus-bar pressure in place of the battery. The Weston voltmeter is simply a modified form of a D'Arsonval galvanometer. Since the deflection on the voltmeter scale is directly proportional to the current flowing through the voltmeter, it is evident that if we connect the voltmeter between the bus-bar and the end of the cable, as shown in diagram 2, the deflection on the voltmeter scale will be a direct indication of the current flowing through the voltmeter and the insulation of the cable, from which we readily obtain the resistance of the cable. An ordinary portable Weston voltmeter with a range of 600 volts has a resistance of about 75,000 to 80,000 ohms; it is evident therefore that with a bus-bar pressure of 550 volts this instrument will indicate the resistance of the voltmeter, which we will assume is 80,000 ohms; therefore, if when connected, as shown in the diagram, the voltmeter shows a deflection of only one volt or deflection, it will indicate a resistance of 550 times 80,000 or 44 megohms; this then will be the resistance of the voltmeter and cable insulation combined; deducting the 80,000 ohms resistance in the voltmeter we obtain the resistance of the cable in-

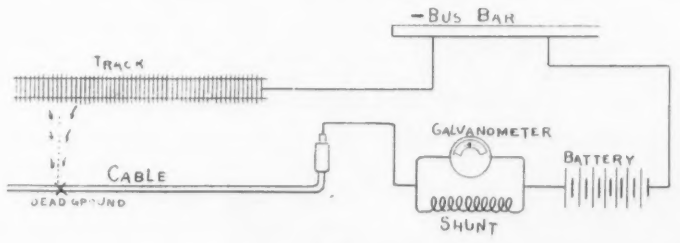


FIG. 1.

sulation. As this limit of the ordinary portable Weston instrument is too low for testing ordinary cables in good condition it was necessary to get an instrument that would have a wider range. At my request the Weston Company made an instrument with one megohm resistance; with 550 volts pressure one deflection of this instrument indicates a resistance of 550 megohms, which is amply sufficient for testing any feeder cable within my experience. The high resistance for this instrument is wound in coils external to the voltmeter proper; these coils serve a double purpose; they not only permit of the use of a more sensitive instrument than the ordinary voltmeter, but the self-induction is so large that they entirely annul all inductive influence due to the varying current strength in neighboring cables. With such an instrument testing becomes very rapid and sufficiently accurate for all practical purposes.

I have tried the capacity method described by Messrs. Houston and Kennelly, but the necessary calculations and the somewhat complicated method, together with the time required, make it far inferior to the method which I have described. If a fault develops in a cable we proceed as follows:

First, the cable must be disconnected from the line; it is then cut about the middle of its length, and by means of a jointed bamboo fishing pole with a hook on the end and a wire reaching down on

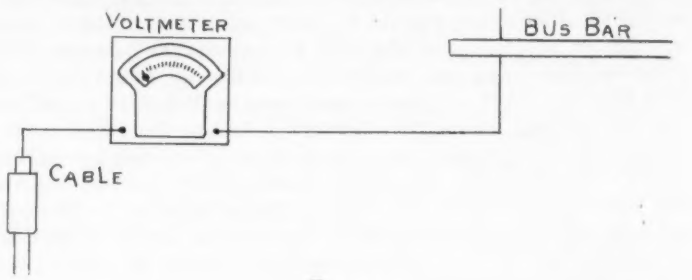


FIG. 2.

the inside, so as to make a complete circuit, the positive of the voltmeter is connected to the trolley wire just above the man-hole, and the negative of the voltmeter is then applied to the exposed ends of the cable in question; a momentary glance at the voltmeter shows on which side of the cut the fault lies, the actual resistance being of no importance at this time. By being able to make this test at the point of cutting much valuable time is saved, and it is an easy matter to run down a fault in a cable several miles in length in one day; whereas, with the former method of doing all the testing from the station end would often consume several days. This method of testing being so simple and easily applied, we at once extended it to making nightly tests of all our feeders, including the sections of line to which they were attached.

During the hours between 1 and 5 a.m. many roads are shut down entirely, while at the most in large cities but few night cars are in operation. The switchboard man, by watching the ammeter, can readily tell whether there is a car on any section or not; as soon as he finds the section without load he opens the feeder switch and applies the terminals of the voltmeter across the switch, as shown in diagram.

The deflection on the voltmeter indicates the resistance, not only of the cable, but all the line work on that section. There will of course in each station be a few feeders which supply lights to depots, etc., which cannot be tested in this manner, but the majority of feeders can be so tested, and the information becomes of considerable value. One man can readily test from 35 to 40 feeders in one half hour, and in one of our stations where we have over 150 feeders the men find no difficulty in getting over the entire board every night without interfering with their other work. A single night's record is of no particular value in itself, but by comparing the records of each night with those preceding the indications become of use. If after several days of clear weather any particular feeder shows signs of decreasing insulation, that feeder is thrown out of service; first the cable is tested, and if found good the section of the line is then carefully gone over and the cause of weakness removed; in this way many burned-out cables and vexatious delays have been forestalled.

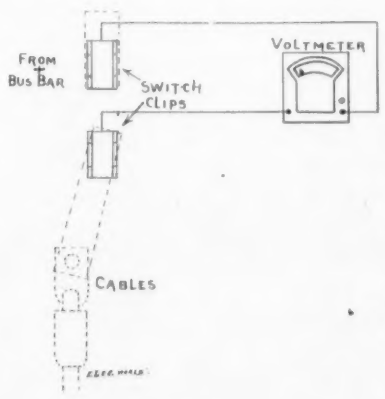


FIG. 3.

At the present time we are making nightly tests of over 300 feeders, supplying over 400 miles of trolley wire, and we do this without in any way interfering with the other work in the station or with the operation of the lines. If those railway companies who have never tried this, particularly in large cities, will use such a system, I think they will be gratified with the results. For ordinary nightly testing the ordinary portable Weston voltmeter of 70,000 to 80,000 ohms resistance is all that is necessary. For accurate cable testing I would recommend the high-resistance instrument.

The Princeton Sesquicentennial.

BY WILLIAM HENRY HALE.

The impressive celebration which marked the completion of a century and a half of the life of Princeton University—previously called the College of New Jersey—while interesting to all who know the important place which this institution and her sons have filled in American history, has a special significance to physicists. Princeton was the home of Joseph Henry, as it now is that of Charles A. Young, and the brilliant company of delegates to the celebration and recipients of honorary degrees included Josiah Willard Gibbs, now regarded as the foremost physicist in America, and Joseph John Thomson, the young but renowned professor at Cambridge, and Lord Kelvin, though not present, sent congratulations by cable and was invested with the degree of Doctor of Laws. To the writer the occasion had a personal interest, from the fact that his school days was passed in the old Albany Academy, the scene of Henry's first discoveries in electricity, before Princeton called him away; and from the further fact that while the degree of Doctor of Philosophy was yet new in this country, the writer shared with Gibbs the honor of winning that degree at old Yale, on the third occasion when it was ever conferred in America.

Quite a delegation came to Princeton from European universities, and six of the visiting professors gave lectures during the week preceding the sesquicentennial. Four of these lectures were by Prof. Thomson on the discharge of electricity in gases. Prof. Thomson also gave a public explanation of the system of graduate courses in Cambridge, which have recently been opened to graduates of other institutions. A meeting of the American Mathematical Society was held, at which Prof. Klein explained *n*-dimensional space by the mathematical theory of the top, and Prof. Thomson gave the results of his recent experiments with Röntgen rays, and discussed the theories of scientists regarding these rays.

The exercises of the celebration were held on Tuesday, Wednesday and Thursday of last week, Thursday, Oct. 22, being the anniversary of the signing of the charter. The opening service on Tuesday morning was a religious one. President Patton preached a sermon on the relation of religion to the university, in which he discussed topics of current interest, both national and international, including some timely reference to the political issues now before the people. He expressed the hope that peace would henceforth forever prevail between the two great nations of the English people, and, again, on the last day of the celebration he called attention to the importance and value of these international collegiate reunions in promoting the amity and concord of nations. Both these sentiments were heartily applauded.

At the reception of delegates on Tuesday afternoon the Rev. Dr. Howard Duffield, of New York, gave the address of welcome. President Eliot, of Harvard, responded on behalf of American, and Prof. Thomson on behalf of foreign universities. The last address was extremely felicitous, and almost constantly applauded. Especially graceful and pleasing was his statement when speaking in "Princeton University, panoplied in her patriotic traditions and glorious memories," as Cleveland afterward characterized the university, Princeton, which supplied three signers of the Declaration of Independence, and nine members of the Constitutional Convention, and which was a battlefield of the Revolution. Prof. Thomson, speaking at Princeton, said that he and his fellow-countrymen of England now rejoice with us in the result of the Revolution, believing it to be, after all, the best for all parties.

On Tuesday evening an orchestral concert was given, led by Damrosch.

The poem on Wednesday morning was by Rev. Dr. Henry Van Dyke, on the subject "The Builders," and the oration by Prof. Woodrow Wilson, on "Princeton in the Nation's Service."

The parade on Wednesday evening was a grand torchlight procession, reviewed by President Cleveland and Mrs. Cleveland. Eight years ago I attended another academic festival, the only one in American history which is comparable with Princeton's, namely, the quarter millennial of Harvard, and there also I saw the same President with his wife, then a young bride. The parade had representatives from every class but two, from 1839 to the end of the century.

On Thursday morning, announcement was made of gifts to the university aggregating $1,353,000, and of the change of name from the College of New Jersey to Princeton University. Fifty-nine honorary degrees were conferred on some of the most eminent scholars in both hemispheres. All the recipients were present except Kelvin and Struve, and 11 of them were from abroad.

President Cleveland's address was a noble and statesmanlike paper, in which he spoke clearly, logically and forcibly of the political problems of the hour, considered on the broad ground of general principles. The elegance of his style was a surprise to the audience, and his sentiments were heartily approved and enthusiastically applauded.

The New York Electrical Society.

The adjourned meeting of the New York Electrical Society was held on the evening of Oct. 23 at Columbia University. President Dr. Chas. E. Emery delivered his inaugural address, entitled "Reminiscences of Forty Years of Engineering Experience." He discussed the advantages of compound and triple-compound engines, and pointed out it has recently been demonstrated that the number of cylinders has in many cases been increased unwarrantably, and that for pressures not exceeding 125 pounds fully as economical results can be obtained with a compound as with a triple-compound engine.

Dr. Emery was one of the judges at the Centennial Exhibition in 1876, and he referred to his experiences on this memorable occasion, and his connection at the same time with the standardizing of boiler horse-power. The "Centennial" standard is now generally adopted in rating the steaming power of boilers.

The New York Steam Company's system was then described briefly, and the expansion joints, meters, etc., developed in this connection were also referred to. His connection with the improvements in the terminal facilities of the Brooklyn Bridge and his advocacy of the use of electric locomotives in this service were next touched upon. Dr. Emery's address was brought to a close by a brief reference to his experiments on electrical subjects and some interesting features of the tests of the large engine dynamos at the Chicago Exposition by a committee of judges, of which he was the chairman, and which resulted in the discovery at that time of the losses which have been particularly described by Mr. Otto T. Bláthy in THE ELECTRICAL WORLD. The publication of the results of these experiments have been so long delayed that Dr. Emery contemplates making a full abstract of the same for the benefit of the profession, without, however, referring to any particular exhibition.

Death of Mr. Greathead.

Mr. James H. Greathead, the well-known engineer, died in England last week at the age of about 50 years. He was born in England and began his professional career as a draughtsman in the office of Sir Marc Isambard Brunel, the engineer who built the Thames Tunnel, the *Great Eastern* and the London & Great Western Railway. Mr. Greathead's fame comes from the method of tunnel construction which he invented, and which is now generally adopted in operations of this character. The City & South London Electric Railway was built upon this plan, and was a financial success from the start mainly, it is stated, on account of the tunnel construction and its economy.

The Greathead system was adopted in the tunnel operations in Berlin and Paris, and was used in the construction of the North River Tunnel at New York. Of the latter enterprise Mr. Greathead acted as consulting engineer. He never visited America.

The Ohio Electric Light Association.

The convention of managers of electric light stations in Ohio was held in Springfield on Oct. 13 last, about 75 representatives of various electric light companies in the State being present. Mr. A. W. Field, manager of the Columbus Electric Light Company and president of the association, occupied the chair.

Several questions of interest to the electric light business were freely discussed and some able papers were read, among the latter being one on "Arc Lights From Incandescent Circuits," from Mr. Lindsay, of Cleveland.

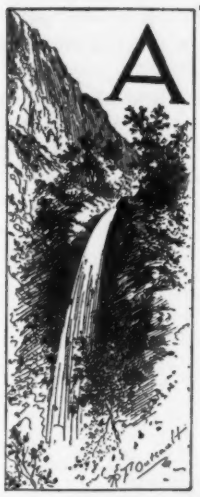
The election of officers for the ensuing year resulted in the selection of the following named gentlemen: President, John L. Beggs, of the Edison Electric Light Company, Cincinnati; vice-president, G. S. Long, of the Troy Electric Light Company; secretary and treasurer, Samuel Scovil, of the Cleveland Electric Illuminating Company.

It was decided to hold the next annual meeting at Cincinnati, and the mid-summer meeting, which is a social feature, will be held next Summer at Put-in Bay.

The Luminous Fountain at the Millennium Exposition in Budapest, 1896.

BY JOSEF HERZOG.

Introduction.



AT the exposition in London in 1885 a luminous fountain was erected by the firm of Galloway & Sons, which at that time was one of the chief attractions of the exposition during the evening, notwithstanding the small amount of light with which it was illuminated as compared with its successors.

Since that time every noteworthy exposition has had its magic fountain, and no matter what system was employed or upon what scale the fountain was built, it has added materially in enlivening the evening promenade by its magnificent appearance.

At the Millennium Exposition in Budapest, it has also been demonstrated that the variegated color effects of the illuminated fountain have far greater attractions for the general public than the best regimental band. How few there are who would consider while looking at these beautiful water effects the amount of patient work which was expended in the production of such a spectacle. Few are aware of the fact that under the playing waters a dozen men are busily engaged in a moist and heated room in hard work in order to produce this enchanting sight.

In the following article I propose to describe the origin of the project of the Budapest luminous fountain, how it was built, its special equipments and how it is operated.

The Origin of the Project.—The erection of a fountain at every exposition has generally been brought about through the initiative of a local firm which was willing to make sacrifices and had the desire to show that in their country also science and industry had reached an advanced stage, and that they could demonstrate, even to a critical eye, that the technics may not only produce useful but also magnificent and delightful results; so it was here.

The firm of Ganz & Co. in 1894 submitted plans to the exposition authorities. After a short time these plans were approved, with slight modifications in their details of construction, and this firm was commissioned with the erection of the luminous fountain. The motive was the tale of the great poet "Arany," of the fairy "Sio," of the "Plattensee." The group on the fountain represents the lucky sequence of this story.

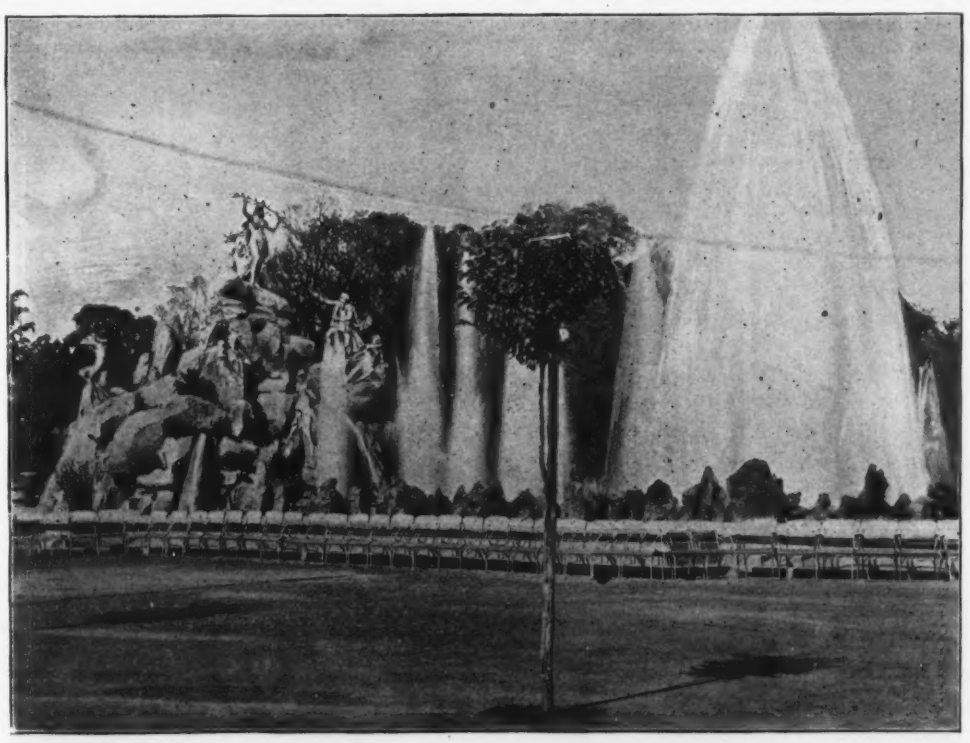


FIG. 1.—ELECTRIC FOUNTAIN AT THE BUDAPEST EXPOSITION.

The various groups of the sculptural part were individually examined and passed upon by the directors of the exposition before being cast in zinc. Each of the figures fully conforms to the ideas of the fairy tale, and each attracts the attention of the spectator by its delicate execution; and if the single fountains are arranged properly in architectural style, they will form a beautiful whole.

The location of the fountain was not the best that might have been obtained, but a better one could hardly be found within the exposition enclosure, unless the corso had been transferred to the lake shore. In this case the fountain itself could have been built on an elevated platform within the lake or in an elevated position on the high walls of one of the buildings of the historical section. A separate building might have been erected on the lake shore opposite the lake corso. These plans would have deprived the Industrial Hall of the distinction now accorded to it, and I might say of its historical distinction. This location, though somewhat unfavorable on account of its depression, was finally agreed upon, as it affords a view of the group of rocks from both sides. It may, however, be stated in this connection that the expositions in Prague and Frankfort clearly demonstrated that a high position for a fountain increases the effects of the same.

It was stated at first that the group of rocks would be equipped with water coloring devices for the purpose of illumination. The idea, however, was abandoned, and the illumination of the rocks was decided upon in order to give the evening visitors a chance to see the artistic groups and effects. This illumination was made from the dome of the Industrial Hall by means of reflectors which threw the light down upon the rocks.

The Erection of the Fountain.—The work was commenced on Aug. 26, 1895, and finished in February, 1896. Underground water nearby and a stratum of sand rendered it necessary to construct walls of planks and to use a three-hp pump continuously for three months in order to remove the accumulating water from the works.

Reference to the ground plan of the foundation in Fig. 2 shows that the construction is divided into four sections underground, namely:

The large chamber, 15.6 x 9.6 metres in dimensions.
The small chamber, 6 x 10 metres.
The eclipse or slide chamber, which is 8.3 x 6.2 metres.
The hall, which is 2 x 15 metres.

In the chambers cast iron columns support the ceiling. The foundations of the walls of the four sections of the fountain below the ground and of the columns were started immediately after the plank walls had been put in position. Beton floors were then laid in the large and small chambers, two layers being put down, one of 30 and one of 20 centimetres in thickness of a composition of 1:5. The first layer was allowed to stand for three weeks, when it was accepted as being strong enough, and then the second layer was put down. Three asphaltum-felt insulating layers were also built in and the three wells surrounding the fountain which had been pumped dry were then closed. The insulating layers of asphaltum were put down in order to prevent the admission of underground water into the fountain. After that the foundations were interconnected by ribs, and all the larger layers of beton were stiffened by ribs and connected with the walls by brackets. The floor of the chambers was further covered with a layer of finishing material of about 10 centimetres in thickness and composition of 1:2. The floor was laid at a slight incline toward one corner so as to collect the drip and water, from which point it is pumped by an electric pump through a pipe and ejected into the adjoining canal.

The group of rocks was built according to the Mounier system and in the general form of a dome with an interior diameter of 4.6 metres and an elliptical ground plan whose longer axis was 8.5 metres and the smaller 6.2 metres. The thickness of the Mounier layer is about 12 centimetres. Upon the dome are placed the single rocks made out of slacked beton (mortar). The masking of the light shafts was

also effected by groups of rocks of the same material. In the construction of the vaults trusses weighing in the aggregate 11,000 kilograms were used, the largest of which was 300 millimetres in height. In this work altogether 890 cubic metres of beton were used.

Generally speaking, the fountain consists principally of an hydraulic plant, an electric plant and the necessary appliances for producing change of colors. The hydraulic plant consists of two Worthington steam pumps of a capacity of 12,000 litres of water per minute running at a normal speed of 45 revolutions per minute. With these pumps the pressure on the fountain is kept between one and six atmospheres, according to the forms of the various jets and the height to which the same are projected. The pumps take the water from the basin of the fountain through five suction pipes. The water then passes through a system of pipes 500 millimetres internal diameter and 500 metres long. It is then forced through another system of pipes 400 millimetres in internal diameter into the underground chambers

From these points it is divided into single jets as shown in the sectional view, Fig. 3. A large pipe system along the floor of the underground chambers leads to the parabolic jets issuing from the rocks, thence to the elliptical chamber around which it is carried. From these pipes seven smaller ones lead off to the seven nozzles in the dome.

The other nozzles receive the water through the pipe system laid in the basin. Hence, the jets and nozzles when in operation can be adjusted in groups from the underground chamber by valves.

The parabolic jets are permanently fixed and act in a certain sense as safety valves for the entire pipe system for the reason that they are always open and with increasing pressure eject more water.

The rest of the pipe system consists of two main groups. At the centre there are eight light shafts and toward the rocks there are six, each with one central jet and a surrounding "garb." The garbs consist of single thin streams of fine jets and are arranged alternately with solid jets.

There are eight valves in all for the control of the various garbs and streams, of which there are in all 15. A safety valve is provided for this system of subsidiary valves.

The normal pressure in the fountain is three atmospheres. At this pressure it is possible to illuminate in three colors, stream 9, which is three centimetres in diameter. In most cases, however, a pressure of five atmospheres is necessary.

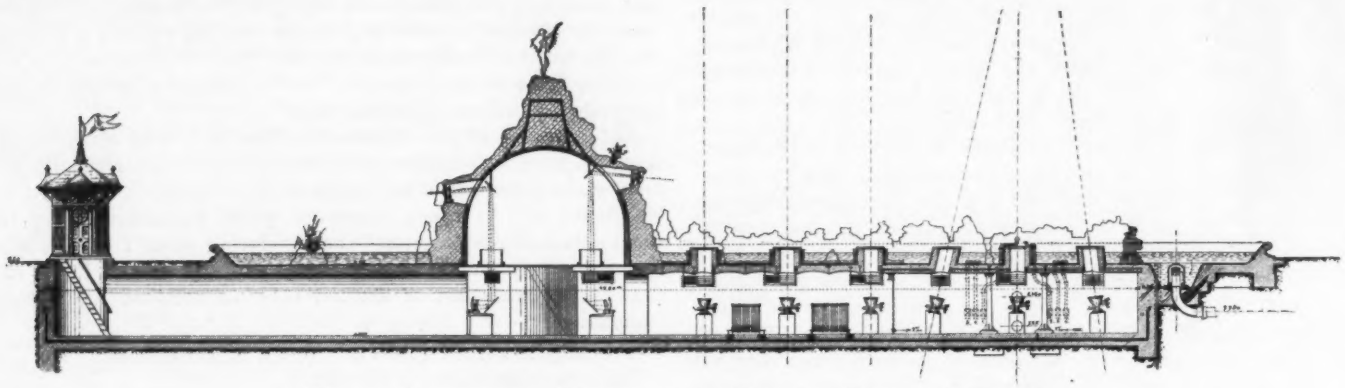


Fig. 2.—Longitudinal Section of the Budapest Electric Fountain.

Electrical Equipment.—This consists of three dynamos of the Ganz C type, which are installed in the Ganz pavilion (see Fig. 3). There are two 60-kilowatt and one 100-kilowatt. The two small machines are held in reserve, each being driven by a 75-hp vertical, high-speed engine manufactured by the firm of Ganz & Co., and directly coupled to the dynamos. The large dynamo is driven by a 160-hp engine of the same type and is also directly coupled. The current is conducted to the fountain by two copper cables of 150 square millimetres, which are carried along near the water-pipe system.

Under each light-shaft there is provided a reflector, four of which consume 42 amperes at a pressure of 300 volts. Each reflector is provided with variable resistances, the subdivisions of which may be cut in and out of circuit by means of plugs. The reflectors are parabolic and the arc is located at the focus, the carbons being so placed as to turn the arc toward the top of the fountain. The length of the arc is from three to five millimetres, and the regulation of the

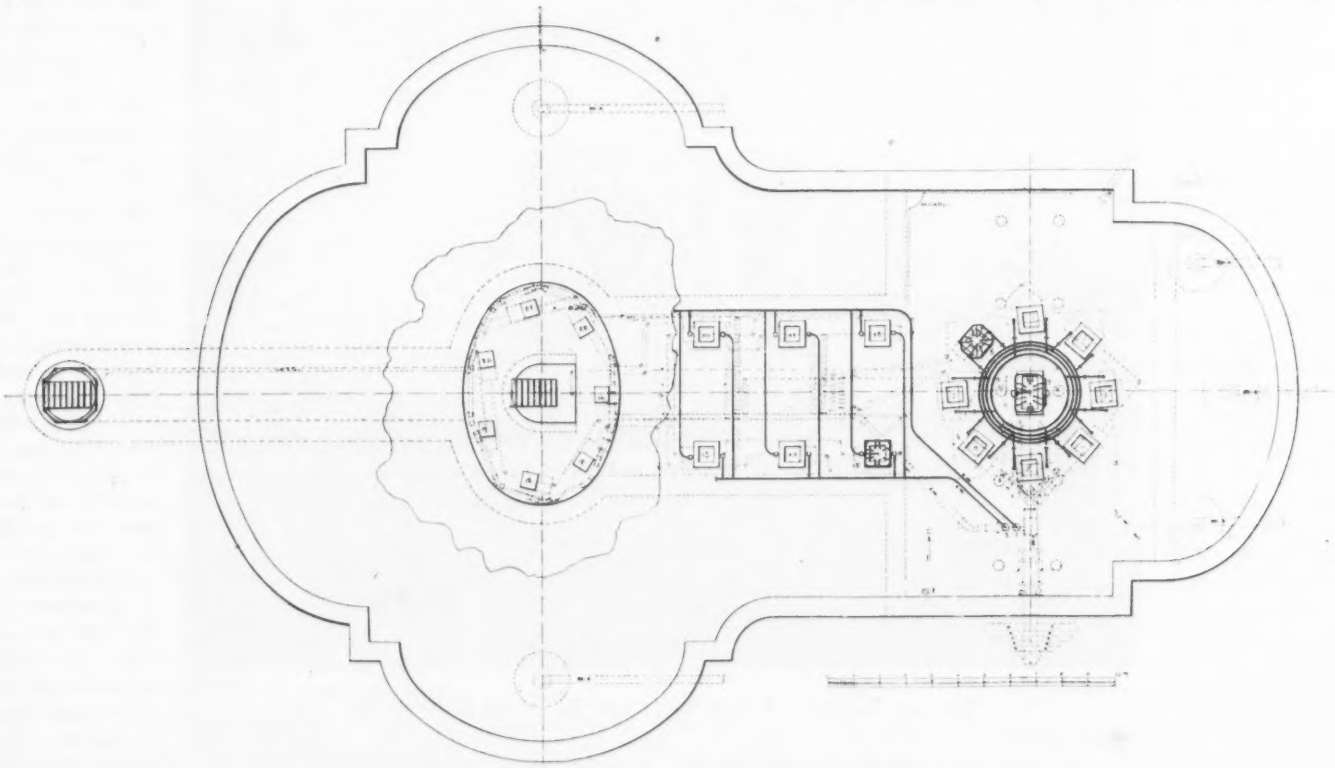


Fig. 3.—Plan View of the Budapest Electric Fountain

lamps is effected by hand-power. All of the lamps are mounted on wooden bases and these rest on insulators of porcelain.

The lamps for the parabolic streams issuing from the dome are of different construction. In these the carbons are nearly vertical and are placed practically at the focal point of a spherical mirror, which throws the rays of light to a plane mirror mounted on a horizontal plane and at an angle of 45 degrees. This latter mirror reflects the converging rays to another similar mirror immediately above and in front of the nozzle of the parabolic jet at an angle of 45 degrees to the vertical plane mirror from which the rays are reflected, converging the latter into the hollow nozzle, and consequently illuminating the hollow parabolic stream of water. The lamps used for this latter service may be adjusted in several ways. The lamp, the

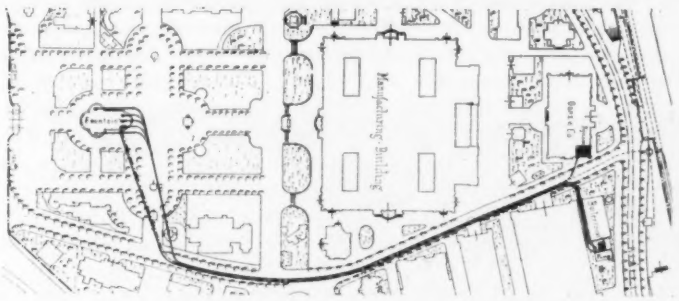


FIG. 4.—PLAN OF EXPOSITION GROUNDS.

spherical mirror and one of the plane mirrors are mounted on an iron frame which is fastened to a similar horizontal frame by means of hinges, which permits of the adjustment of the combination so that the plane mirror may be inclined at any angle greater than 45 degrees with the horizontal. The lamp itself may be moved from the spherical mirror and brought nearer to the plane mirror or *vice versa*, and the negative carbon may be moved to the right or left, backward or forward, toward the plane mirror by means of micrometer screws. The top plane mirror, which is at an angle of 45 degrees, may be moved in any direction.

The operation of the fountain, mechanically, hydraulically and optically, is based on simple principles. These consist in illuminating the water jets by means of colored glasses and strong reflectors, whereby only those portions of the water on which the light falls and not the rays of light themselves become visible, so that each drop appears to be light-emitting.

Every light shaft is covered with a strong glass plate 1 millimetre thick over which are bent the pipes for the garbs and jets as shown in Fig. 2, which gives a longitudinal sectional view of the fountain.

The reflectors throw the light through the interposed colored discs and through the glass plates into the garbs surrounding the stream communicating to both the colored light.

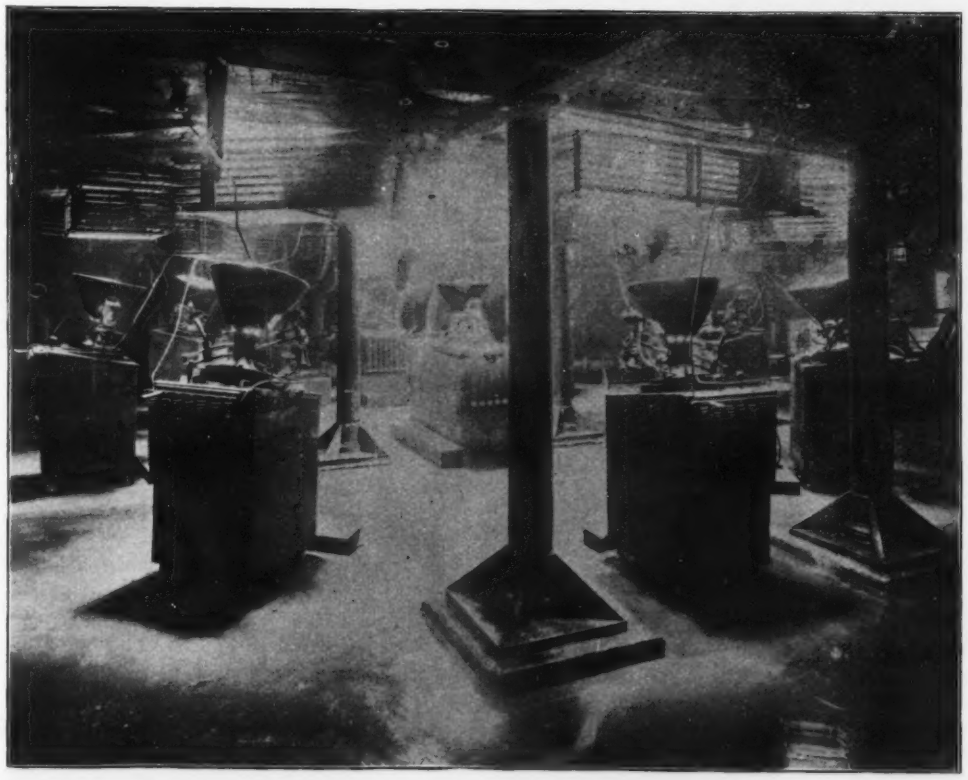


FIG. 6.—LAMP CHAMBER OF THE BUDAPEST ELECTRIC FOUNTAIN.

The method of changing the colors is an extremely simple one. Above each lamp near the parabolic streams and between the two inclined mirrors above referred to are provided flat iron supports on which are placed five horizontal circular frames one above the other. Each frame is divided into squares of 160 millimetres in width and in these squares are placed the colored glasses. Underneath these is a network of wire with meshes of five centimetres in order to catch any glass that may become accidentally broken and prevent its falling down onto the lamp. The lowest frame is covered with red glass, the next with yellow, the next with green,

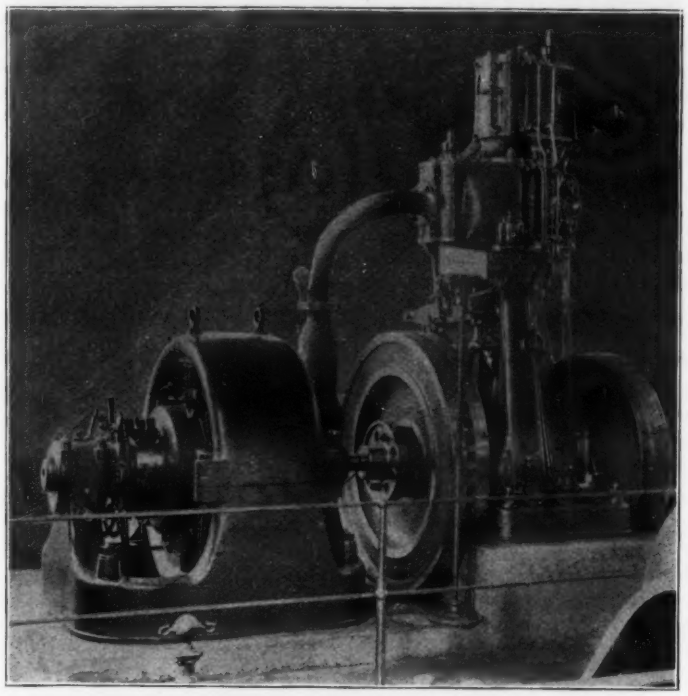


FIG. 5.—DIRECT-CONNECTED GENERATING SET.

the fourth with dark blue and the last with light blue, and the frames are connected with each other by an iron shaft of 3.5 millimetres in diameter. This shaft is used for the purpose of changing the colors alike in its own series of lamps. Each frame is operated by a lever. The device for changing the colors and the levers which control the hydraulic jets are operated after a fixed schedule, a change of color being produced every minute or two. All levers of one group are mounted or fixed on one axis and it is possible to move, by means of two levers on one axis, all of the others.

The five colors are designated by numbers, in combinations of four or three, and according to the same the levers are arranged.

The hydraulic levers provided four positions, namely, closed, half open, two-thirds open and fully open. These positions are arranged in such a way as to give many variations.

In the operation of the fountain 12 men are employed in the underground chambers, one man on the pump and three on the dynamos and engines, and during the illumination each evening each man is kept extremely busy.

The excessive heat and moisture during the operation of the

fountain made it necessary to provide effective ventilation. There is also provided telephonic communication between the pump, steam engine and the fountain.

The Budapest fountain cost 150,000 florins, exclusive of the cost of the steam engines and pumps. It contains only one half the number of pumps used in the Paris fountain, although the same system was employed there.

It may be of further interest to state here that the fact was discovered that a thin sheet of water transmits and reflects light in a much more satisfactory manner than a hollow or full stream with a round or elliptical section.

The Extensions to the Liverpool Overhead Railway.

The Liverpool Elevated Electric Railway, which has operated so successfully since its inauguration a few years ago, has now, for a second time, been extended. When first opened the line was 5¼ miles in length, this costing something like $450,000 per mile to construct. In 1892 it was considered advisable to extend three-quarters of a mile to Seaforth, and this section, which was opened in 1894, is stated to have fully justified its construction, the number of passengers carried having increased from 2,475,639 for the six months ending Dec. 31, 1894 to 3,780,375 for the six months ending Dec. 31, 1895.

Before the meeting of the British Association just concluded at Liverpool, Mr. S. B. Cottrell, the manager of the line, read a paper on this railway, and special reference was made to the southern extension which is now approaching completion. He also gave tables showing comparisons of the working of this system with the City & South London Electric Underground Line, also a dissection showing the cost per train-mile during the half-year ending June 30, 1896, which was as follows:

	Lbs. per train-mile.	Lbs. per kilowatt.	Pence per train-mile.	Pence per kilowatt.
Train mileage 313,010. Kilos generated (exclusive of battery charging) 1,343,129.				
Generating Station: Coal.	18.24	4.253	.491	.115
Ashes.			.016	.003
Stores.			.164	.039
Wages.			.763	.176
Repairing Department:				
Stores.			.425	.099
Wages.			.321	.074
Driver's Department:				
Wages.			1.220	.287
			3 400	

Diagrams which accompanied the paper showed the load at the generator station, 13 trains on the line, as 998.0 average amperes 448.8 average volts; curves of torque, efficiency and speed; and a curve of electrical horse-power used by one test train from Toxteth to Alexandra.

The southern extension, which is five-eighths mile in length, commences about 150 yards north of the present terminus of the railway, with a viaduct 250 yards long, crossing Sefton Street and the Brunswick Goods Yard of the Cheshire Lines Railway, a portion of the Dock Board Estate and entering the hill side at the northeast corner of the Herculaneum Dock, and proceeds in a southeasterly direction to Park Road.

To meet the requirements of the Dock Board, their land is crossed by one span of about 200 feet, the main girders being 220 and 225 feet respectively, and the whole of the span will weigh about 212 tons.

The tunnel portion, about 800 yards, is almost entirely through red sandstone rock, which, like all Liverpool rock, is of a very treacherous character, heavy backs and wet clay beds being frequently encountered; heavy timbering is thus necessitated. A large number of the crown bars had to be built in, and the tunnel had therefore to be lined throughout its entire length; all the lining is faced with Brindle bricks built in cement. At about 170 feet from the entrance the tunnel crosses at an angle of 28 degrees, 27 minutes, 40 seconds over the tunnel of the Cheshire Lines Railway. The greatest distance that could be allowed between the overhead rails and the crown of the Cheshire Lines tunnel is two feet 9 inches.

The trains, on entering the tunnel, will be automatically lighted from copper conductors suspended from the tunnel roof, collectors being fixed on the roofs of the carriages. These lights will be fed by accumulators, so that if a train should be stopped in the tunnel, due to short circuit on the line, carriages will not be in darkness. The terminal station of this extension is situated at Park Road, below the road level. The underground station will be ventilated by a large up-cast shaft. The access to the station will be by means of a subway. The station will be electrically lighted throughout, the underground portion by arc lamps supplied from a transformer off the main current.

More generating plant was required for working the additional trains, and the size of the present generating station was increased, feeding cables being run a length of about two miles in order to regulate the E. M. F., instead of building another generating station—it being considered that this method would cheapen the working costs. Two engines have been put down (Hick-Hargreaves), each intended to give 400 indicated horse-power. They are of the horizontal surface-condensing Corliss valve type. These will drive by means of ropes two dynamos giving an output of 500 amperes each at 500 volts, and a speed of 420 revolutions per minute.

The armatures are interchangeable. The resistance from brush to brush measures .010 ohms. The magnets are of the single horse-shoe type with the poles at the top, instead of the double as supplied with the other dynamos already running. This, Mr. Cottrell states, has resulted in an increase of efficiency, the shunt resistance being now 100 ohms as against 75, making an electrical efficiency of 98 per cent. The loss in hysteresis, eddy currents, windage, etc., amounts to 6000 watts, so that the commercial efficiency at full load will be about 95.7 per cent. The ropes (1¼ inch) run between the bearings, the pulley shaft being connected to the armature by a coupling, so that the armature can be changed without disturbing the ropes. The total weight of each machine is 24½ tons, the armature alone being 3 tons 2 hundredweights; the steel magnets casting without winding weighs 12 tons. The main switchboard consists of six slate panels with sets of switches and instruments, one set for each of the dynamos in generating station. The new rolling stock consists of trains composed of three carriages instead of two. The motors were built by the Electric Construction Company, of Wolverhampton, and are very similar to those already in use, their strength being increased to meet the additional weight of trains.

Sir Douglas Fox and J. H. Greathead were the engineers who planned the extension, and Mr. Cottrell, the author of the paper, acted as resident engineer.

New Method of Resuscitation.

A queer story comes to us from a reliable source in Anaconda, Mont., giving an account of a new method of resuscitation from apparent death from accidental electric shocks.

Jack Helner, who has charge of the electric crane at the foundry of the Anaconda Copper Mining Company, recently received a heavy electric shock which knocked him senseless, and he fell from a ladder which he was at the time climbing. Although he still breathed he was apparently in a serious condition, and the usual expedients were resorted to to revive him, but without success. One of his fellow-workmen, in the absence of a doctor, applied a new method of treatment, which the physician, who arrived after Helner was resuscitated, declared as being instrumental in saving the man's life. This new way of resuscitating was nothing more or less than laying the victim in a bed of molder's sand, after divesting him of his clothing, and burying him in the same material, leaving only his mouth and nose exposed to the air. A hose was then turned on, and the unfortunate man was thoroughly soaked in his improvised grave. In a short time he opened his eyes and was brought back to life. A stimulant was given to him and then the doctor arrived, finding, however, that there was nothing for him to do. Helner went through a precisely similar experience on a second occasion, receiving a shock of a 500-volt current. He was stripped and laid in a bed of sand as before, a stream of water was applied and he soon came to again. The story is now going the rounds that he was twice killed, buried and brought to life.

Pneumatic Ear Cushion.

A German contemporary shows a telephone receiver which has on its face a small hollow rubber ring (like a bicycle tire, only quite small), so that when held to the ear it fits it closely, thereby excluding all other disturbing sounds.

Combined Stations.

In the cities of Geneva, Hamburg, Berlin, Rome, Havre, Plymouth and Baden near Vienna, the central lighting stations also generate the currents for the electric railways.

Electrical Effects in Political Parades.

The political parades of the present campaign have been different in one respect from those of former years. In point of beauty, or at least in startling spectacular effect, they far outstripped anything accomplished during Presidential contests of the past. This is due chiefly to the ready facility of adapting electricity to the needs of the moment. Several local campaign managers recognized the great possibilities in illuminated advertisement which lay in this direction, and orders were given to large electrical manufacturing firms for devices which illustrated some great political truth or idea, as laid down by the various factions. In short, many have witnessed pageants in which electrical displays formed a leading feature.

The wily political manager knows that most people use their eyes more than their ears. An argument without words is the most forcible after all. Therefore the knowledge that an electric current may be conveniently carried along the street and used to illustrate the great utility of either monetary standard, will be most welcome to political clubs which intend making effective displays. How to do it and as cheaply as possible, is the first question that will be asked. It may be generally answered by saying that wherever a trolley line is within reach, or storage batteries are available, the most wonderful electric effects may be cheaply obtained. The following devices, many of which are being used during the present campaign, may be constructed by a tyro in electrical knowledge. To the man of inventive mind, they will naturally suggest others more original, so that we may look for any number of interesting displays.

One of the most beautiful displays may take place in New York. The idea for it was borrowed from one of the local churches. It is an illuminated statue or bust of McKinley which will be hauled along on an elevated platform. The statue will be made of alabaster, or of some similar composition, and will be surrounded by an effulgent light which will give it a brilliant appearance. The light will emanate from the statue itself and doubtless many spectators will be mystified as to its source. As a matter of fact the statue will be hollow, and a number of incandescent globes placed inside of it will supply the light. Every vein in the stone will show out, giving to the whole affair an air of beauty which could not otherwise be obtained.

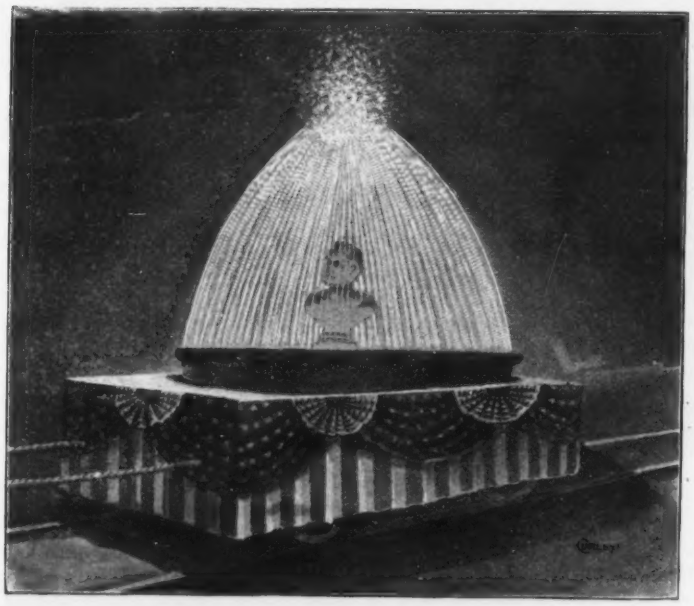
It has been suggested that the illuminated waterfall, such as was used at the Chicago World's Fair, be adapted for use in political street parades. At first glance the project seems to present insurmountable difficulties, but it may be carried out, nevertheless. The idea embraces a marble bust of McKinley or Bryan, which should stand in the centre of the fountain, the water of which will stream upward from the outside rim of the fountain-basin and fall over the statue in the centre. As the float carrying the display moves along the street, the rising water constantly changes color, assuming in succession all of the primary and secondary hues. The changing colors are obtained by means of powerful concentrating lamps concealed under the fountain. The fountain-bottom is perforated with

SOME ELECTRICAL EFFECTS IN STREET PARADES.

several holes which are covered with glass. Through these windows, colored light-rays are shot upward, the hues being changed by means of slides. The same water is, of course, used over and over again, being collected in the centre of the fountain-basin and forced by means of a small pump into a perforated iron pipe which encircles the outer edge of the basin. The flow being strong, it rises over the centre of the bust and falling on the head and down the sides, runs naturally into the pump again. The pump is electric and, together with the lamps, gets its current through a trolley-pole from an overhead wire. Naturally, such a contrivance could be operated only along trolley railway routes, but the extended use of trolley cars in most of the larger cities would enable the scheme to be carried out. The float could be hauled by horses, and the current received through a flexible wire attached to a trolley. The latter could be easily shifted from one trolley line to another as the parade turned corners.

It has been definitely decided by one political organization to reconstruct a feature of one of the parades of the Blaine campaign. This is, to have a large number of men in line, each one being fitted out with a helmet surmounted by an incandescent lamp. The idea will be enlarged upon this year. The men in line will draw a large float which will carry storage batteries. The very ropes which haul the wagon are really insulated cables along which the current passes. At certain distances apart the insulation is to be cut through and a snap lamp socket attached. The lamp on each man's helmet is to be connected to this socket by means of a flexible supply wire. The end of the local wire will carry a two-pole plug which may be easily put into or taken out of the socket, thus enabling each man to easily detach himself from the line. In addition the float will carry an electric projecting lantern which is to be used to throw names, legends and political mottoes, in letters of light, against the fronts of houses bordering the route of the parade.

The bicycle naturally figures largely in the calculations of political managers this year. The bicycle vote is not to be disregarded. The machine itself is being used in political missionary work and it will soon be in demand as a carrier of election news. It is to be used in street parades and in connection with electricity. Two bicycles joined together are capable of carrying storage batteries from which a current may be obtained sufficiently strong enough to illuminate an electric lamp-sign. Thus the names and purposes of the rival candidates may be made to shine out against the night, for the whole length of a parade. It has also been suggested that the famous sextet of Empire State Express racing fame could be used in connection with the trolley, to carry an immense electric sign having a political significance one way or the other. An electrically lighted bicycle with wheels made to represent immense silver or gold dollars would be sure to be highly appreciated by the crowd.



Electric Fountain Float.

The tricycles which are now used for delivering parcels are just the thing for carrying storage batteries from which a good lighting current may be obtained. Thus illuminated mottoes or emblems, such as "16 to 1," an electric American flag, an incandescent eagle, a silver dollar made of lamps, etc., could easily be carried and operated along the whole length of a parade.

The electric horseless carriage offers a ready means of transporting illuminated devices and signs. The very current which drives

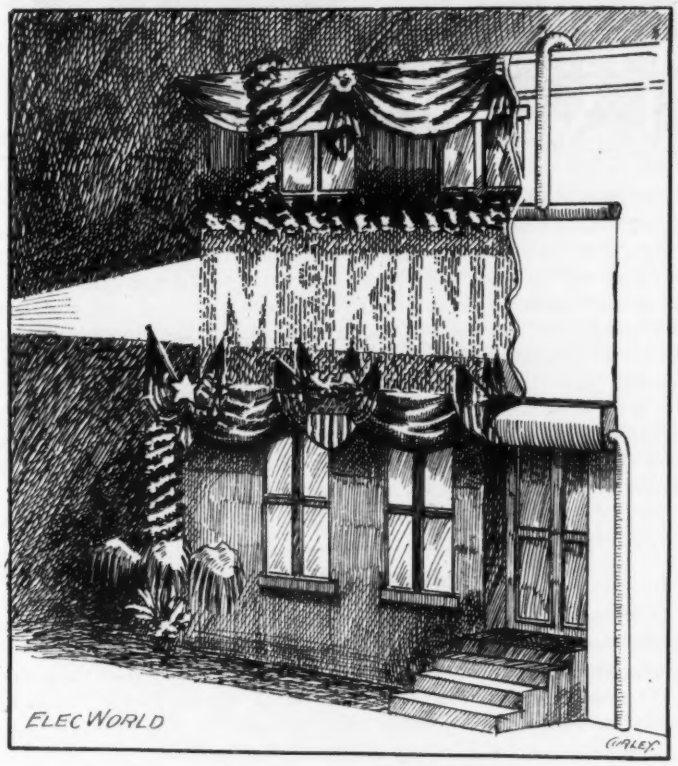
An Illuminated Delivery Tricycle.

the carriage motor can be utilized for lighting purposes for a limited time—long enough at least to outlast the needs of a parade. As it carries its own current the vehicle can go anywhere and the names and emblems of party idols can go with it. Elevated on framework high above the body of the carriage, such devices would attract a great deal of attention. The ease with which a probably successful candidate's bust profile can be made with incandescent lamps, suggests another use for the horseless carriage as a feature in a night parade. Such an arrangement of lamps, if placed on a motor vehicle, would be well worth the trouble of installation.

An Electrically Equipped Wagon.

Wherever trolley car floats are available innumerable electric effects may be produced. Illuminated cartoons or tableaux illustrative of the various political theories, can be shown with any amount of variation, and the influence which long distance trans-

mission of electric power has had on silver production can also be illustrated very readily. Shafts of silver lightning could be actually represented as descending on a gold bug's back, and so on through a long range of ideas and suggestions in accordance with the notion of either party. Temporary work need not require the care necessary where permanent work is desired. Still it might be well to take a lesson from the theatre electrician, whose effects are all transient, but who does his work as though it were to last forever.

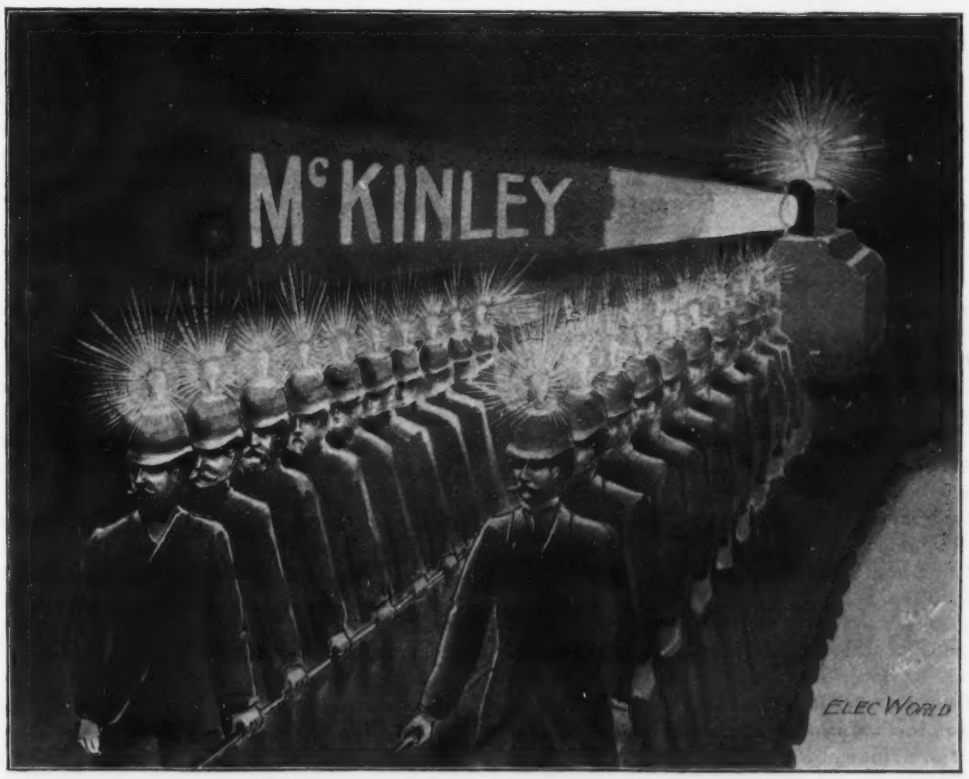


AN ILLUMINATED WATERFALL.

There are political clubs, however, which may confine their energies to decorating their club-houses, situated, fortunately, along the route of the parade. Inasmuch as the installation can remain immovable for the time being, there is no limit to the number of effects which can be shown off as the parade passes. One of the most beautiful comprises a waterfall, which covers the front of a building. The water falls in a solid sheet from the roof and disappears mysteriously in some shrubbery over the first story of the building. Bunting, greenery or similar decoration surrounds the waterfall on all sides. This in itself makes a beautiful picture, but wonderful to relate, a gleam of light begins to shine through the falling water and finally resolves itself into the face of McKinley or Bryan, gazing down at the passing parade. The face disappears and a name in great letters of light takes its place; or perhaps a legend or motto shines out instead. The effect is inspiring, its nature being such as to stamp it strongly on the memory of the onlooker. Yet it is all done in a very simple manner. A large perforated iron pipe is secured under the eaves of the club-house roof. A service pipe connects it with the outlet of a neighboring fire-plug. Water from the plug fills the pipe under the eaves of the roof and falls through the perforations in fine, close streams, which, all together look like a sheet of water. It is caught in an oblong trough and conveyed away to a street sewer by means of a drain pipe. All of this apparatus however is concealed by the greenery or bunting. The faces, names and mottos which appear in the water are produced by means of a projecting lantern situated across the street, or, if possible, behind the waterfall. The thin sheet of water acts as a screen and anything within the range of the lantern can be projected upon it. The combination of water and light is truly beautiful.

AN ELECTRICAL SEXTUPLET.

It has been suggested that vacuum tubes be bent to form a profile of either of the Presidential candidates. The delicate light, apparently rushing through the tubes, which should be hung on the front of a building, or from a cable stretched across the street, would be an inspiring emblem to the passing voters. The idea need not be confined to a profile. It could be arranged in the form of shields, flags, catch-phrases, etc.



HELMETS OF PARADERS ELECTRICALLY LIGHTED.

The value of the electric sign must be apparent to every one. It has, in fact, revolutionized the whole system of night advertising. Electric signs are now constructed which can be made to spell out words and sentences. They consist of a number of lamps arranged on a board, in such a manner that by lighting certain ones any letter of the alphabet may be formed. The operator sits at a machine which is constructed much like the keyboard of a typewriter. By pressing the keys, which are marked with letters, corresponding letters are produced on the sign. Thus, any message may be spelled off. This device is being used to a great extent during the present campaign.

CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION

Under most auspicious circumstances the 15th annual meeting of the American Street Railway Association was held in the Auditorium Building, St. Louis, Mo., on Oct. 20, 21, 22 and 23. It was the general opinion that the attendance was the largest and most representative of any of the Conventions, while the exhibits far eclipsed in extent and interest the record of previous years. The good people of St. Louis are noted for the generous hospitality they extend to visitors, but in the present instance they quite outdid their own high reputation in that direction.

Tuesday, October 20.

President H. M. Littell, of New York, called the Convention to order on the morning of the 20th, and introduced Mr. Charles Nagle, acting Mayor of St. Louis, who extended to the delegates and their friends a cordial welcome to the city. In the course of his remarks Mr. Nagle said that the great and important change from the horse car to the electric had been brought about, not by the coercive force of the law, but by the native energy and force of the enterprise and genius of the railway men. He considered that those who seem disposed at the present day to rely upon Government, law and protection for all the work that is to be done should bear in mind this fact.

Upon calling the roll it was found that 75 companies were represented. Two others also acquired membership in the association.

The next order of business was the president's address. After thanking the members for the honor bestowed upon him, President Littell also thanked the supply men for the aid which they had rendered the association by taking so much space for their exhibits, the space occupied being the largest of any convention thus far held. No deaths, he said, have been reported during the year in the ranks of the association. President Littell considered that one of the most serious difficulties street railway men have to contend with was the growing disposition of the Government, whether State or municipal, to increase taxation. People seem to forget, he added, that a corporation is simply a collection of persons by means of which individual resources, which would otherwise be frittered away in individual enterprises, are brought under one direction, making possible the success of large undertakings requiring an aggregation of capital. Another severe strain consists in the penalties imposed by courts, for the negligence of employees, the judgment for damages for personal injury now running up as high as $20,000. He believed that no community which has enjoyed high speeds on city thoroughfares would care to go back to the former speeds of five or six miles an hour, and he thought that the only remedy rested with the management, and that was discipline of the force.

The report of the Executive Committee showed that the present membership consists of 164 companies, and that all debts of the association have been cancelled. The committee has decided to issue a monthly bulletin hereafter for the benefit of the members.

The first paper was that of Mr. M. K. Bowen, on "Track and Track Joints, Construction, Maintenance and Bonding." Mr. Bowen, after pointing out that a bevel wheel is for the purpose of centering a car on the track, providing means for a lagging wheel to again catch up, and for maintaining the axles of the car at right angles to the track, stated that wheels should be beveled to conform with the track. He also advocated rails of medium hardness. His experience with cast rail-joints has been most satisfactory, but 154 out of 17,000 being lost. Mr. Bowen also referred to an indicator-car used for testing track construction, the results of tests showing high and low rails, low joints, gauge, draw-bar pull and the variation of the track level, each result being plotted automatically.

In the discussion which followed, Mr. Robert McCulloch said that after testing the cast welded joints with instruments reading to a thousandth of a volt, it was found that the conductivity of the joint was greater than that of the rail. Mr. Bowen thought that extra bonding in addition to the mechanical cast weld was necessary. Mr. Dodge advised that the majority of the track joints be cast at night, so that the temperature will be cooler. He advised a medium temperature, which will depend upon the climate. His experience was that when a track joint broke the casting itself was drawn apart. He found also that amalgamation between the steel rail and cast iron had failed in several joints, thus increasing the electrical resistance. The bonds which are used to supplement the cast weld joint are not cast in but turned around from the outside, and consist of No. 0000 wire, sometimes two bonds being used near the station. Mr. Dodge stated that the rails are ground for two or three feet with an emery wheel in one road, while Mr. Bowen stated that they are simply filed in the cases he is familiar with.

On motion the meeting then adjourned until Wednesday morning.

Wednesday, October 21.

President Littell announced as the first business of the day the reading of the paper, "Street Railway Trucks," by Mr. John N. Akarman. As theauthor was not present the secretary read the paper.

Mr. Akarman gave a brief outline of the history of trucks for street railway cars, beginning with the use of motors on the platform as practiced by Van Depoele, necessitating chains and sprockets. The separate truck was not used until 1887. The author considered that the extended spring base, combined with half elliptic springs, has been the best solution of the four-wheel truck problems. He believed that trucks should be constructed as simply as possible, having but few separate parts. He considered the four-wheel truck as unsatisfactory, being severe on the track, and should only be used for slow speeds and moderate lengths of car bodies. For high speeds and suburban service, a double-truck car, with swivel or pivoted trucks, should be used, thereby completely avoiding oscillation of the car body. He considered that for interurban service pivoted trucks having swing beams, equalizers, elliptic springs and all the parts of a steam road truck were very satisfactory. The question remained whether the severe strains on track construction by single trucks is not so great as to more than make up for the cost of putting in and running double trucks under all car bodies.

The next paper was on the "Modern Power-House," by Mr. Richard McCulloch, which will be published in a subsequent issue. In the discussion which followed, Mr. B. J. Arnold stated that he considered the work of the battery plant installed in the Chicago Board of Trade more severe than electric railway work, because it operates electric elevators in conjunction with constant potential arc and incandescent lamps. The elevators take a current varying from 0 to 800 amperes. The battery acts as an equalizer and takes the surplus load delivered into the bus-bars when the demand on the line is less than the capacity of the generator, and takes three-quarters of the overload when the pull comes. The result is that a 75-kw generator, running from 7 in the morning until 11 at night, at its absolutely normal economical load, is enabled to operate 50 2000-candle arc lamps, 600 incandescent lamps, four 30-hp electric elevators and six 10-hp motors, all running from this one unit, and the unit constantly loaded. The battery, Mr. Arnold stated, is working perfectly satisfactorily, having been running nearly a year and has cost nothing for repairs. He is convinced that the battery auxiliary, when there is sufficient lead installed to do the work, is an eminent success for regulating work and for economical operation of power-stations operating on variable loads. It is necessary to have sufficient lead in the battery, and having that good results will be obtained. It is very important to have a plate suited to the conditions, depending on whether the battery is for the purpose of regulation or slow discharge. In this plant the engines and generators stand idle from 11 p. m. until 7 a. m., the battery carrying the load. This allows 16 hours per day for the engine's economic normal load and with two shifts of labor. Mr. Arnold believes this plan could be effected with economy on street railways. It is only a question whether the increased economy will be more than the interest on

the investment of the cost of the battery. The method employed in the Board of Trade plant is to run the elevators and the battery in parallel with the shunt winding of the generator and by running the lights in the building on a separate set of bus-bars off the compound winding of the same generator, so that the variable load on the elevators is taken care of entirely by the shunt winding and the battery, while the compound winding works constantly on the lighting load; thus one unit does the work without serious fluctuation in voltage.

A booster consisting of a motor generator is employed in the station to charge the batteries, if it ever becomes necessary, while the generators are running on the lines, because then the voltage must remain constant at 125 volts. If it is desired to charge the batteries the auxiliary booster is used to charge the end or regulating cells, while the shunt winding of the generator is working in parallel with the elevators and about 60 of the cells. The elevator service is such as to allow the battery to be charged and discharged in about equal proportions throughout the day, so that it is practically fully charged at the end of the day's run, and at night if they are slightly discharged, they are charged up with the booster by placing the generator end of it in series with the main generator, and at 11 o'clock shut down the engines and run the lights until morning with the batteries. In a railway power station it would be necessary to use the booster to increase the voltage on the long feeder. If the battery was located at the end of the line it would be necessary to use the booster to overcome the pressure at the battery, or else run a separate high-voltage generator.

The next paper was on "How Can the Revenue of Street Railways Be Increased," by Mr. C. D. Wyman. The author said that employees of a road should be instructed to praise up the company at all times and impress upon passengers as much as possible the attention the company was trying to pay toward maintaining the best possible service. Mr. Wyman advocated the use of circulars descriptive of the various points of interest in about a city and facilities offered for reaching the same. He also believed in the use of illuminated signs fastened to the trolley poles, giving specific directions. Illuminated cars used for evening parties are also attractive features and are generally found a source of revenue. It was his opinion that the increased cost of operation of cable and electric roads as compared with the horse railways left the net balance for dividends little or no greater and that therefore no reduction in fare was permissible. Mr. Wyman suggested that all motormen and conductors procure a bond before entering the service of a street railway company, such bond to be endorsed by a guarantee company having offices in all the principal cities. Thus the railway company would be protected and employees to a large extent prevented from dishonest practices.

Thursday, October 22.

Upon the Nominating Committee being appointed by the president, the meeting adjourned until Thursday morning. In the afternoon a trolley party visited the Fair Grounds, where luncheon was served. In the evening a theatre party was arranged for the ladies.

The president, after calling the meeting to order at 10.40 a. m., announced that opportunity would then be taken to inspect the exhibits. Upon reassembling at 12 o'clock the first order of business was the reading of the paper on "Modern Overhead Electric Construction," by B. Willard. The author stated that steel poles were preferable for city thoroughfares, but that wood poles answered every requirement for suburban districts and were at the same time less expensive. The author believed that efficient external line appliances controlled by emergency forces meet the most important requirements and that the most efficient line can be built with a general feeder system leading from the switchboard and controllable as a whole for each individual line, and not separated into sections requiring separate feeders for each section leading from the station. The line is divided into sections by means of sectional insulators, each section so proportioned as to meet the estimated feeding point where the feeder is to be attached. A switch box is placed on the poles at a convenient height, in which is contained two switches and fuses, one for the section on either side of the sectional insulator; the feeder is then divided by connection through each switch so that the feed-wire delivers current to either section through feeder span wires attached to connections on each side of the sectional insulator. When the entire line is in operation there is an equalization of current in all sections and the trolley remains virtually as a solid conductor, but with all necessary features for disconnecting the sections.

The Committee on Nominations submitted the following report:

For president, Robert McCulloch, vice-president and general manager Cass Avenue & Fair Grounds Rail Company, St. Louis, Mo.

First vice-president, Charles S. Sargeant, general manager West End Street Railway Company, Boston, Mass.

Second vice-president, D. B. Dyer, president Augusta Railway Company, Augusta, Ga.

Third vice-president, C. F. Holmes, general manager Metropolitan Street Railway Company, Kansas City, Mo.

Executive Committee, H. M. Littell, vice-president and general manager Metropolitan Street Railway Company, New York City; H. P. Bradford, general manager Cincinnati Inclined Plane Railway Company, Cincinnati, O.; Charles H. Smith, superintendent Troy City Railway Company, Troy, N. Y.; Harry Scullin, vice-president and general manager Union Depot Railway Company, St. Louis, Mo.; George H. Hippee, general manager Des Moines City Railway Company, Des Moines, Ia.

For secretary and treasurer, Thomas C. Penington, treasurer Chicago City Railway Company, Chicago, Ill.

It was moved that the report of the committee be accepted, and the secretary be instructed to cast the ballot of the association for the gentlemen nominated. The secretary cast the ballot.

Mr. Robert McCulloch said in part that all he promised was that while he sat on the executive throne of the association its banner shall not be trailed in the mire.

The Nominating Committee then reported that after due consideration they had named as the expression of their best judgment for the next place of meeting Niagara Falls.

Mr. Lang said that some of the material men have said that they thought there might be a lack of facilities for getting their heavy machinery and cars in and out, and, discussing this matter, he was assured that it will be most convenient to get cars and machinery in and out, owing to connections they propose to make, not only with the street railways, but also with the steam railroads, so that we can assure the builders of cars and other supplies that they will have no difficulty in handling their material.

The recommendation of the committee was adopted.

Mr. Seely offered the following resolution:

Whereas, Suggestions and propositions have been made looking to the consolidation in one body of the American Street Railway Association and the National Electric Light Association,

Resolved, That in the opinion of the American Street Railway Association such union is not called for.

The president put the question on the resolution, which was adopted.

The secretary read a cablegram from Mr. W. J. Carruthers-Wain, of London, England, expressing regret in not being present.

Upon recommendation of Mr. Ira A. McCormick a committee of five was appointed by the president to consider a standard code of rules and regulations for the government of employees. The meeting then adjourned until Friday morning.

Friday, October 23.

When the convention reassembled on Friday morning Mr. W. F. Kelly read an admirable paper on "The Selection and Management of Employees." In the course of his remarks Mr. Kelly said that the idea that anybody can run a street car has in the past resulted in the employment of an army of careless, coarse and incompetent men, who through ignorance and incivility have done more to bring street railways into public disfavor than all the official acts of its managers and directorate. He also stated that improved conditions, shorter hours of labor and better wages have contributed to make the street railway service more desirable and attractive to a high class of labor. Instead of being looked upon as formerly as a makeshift job, a chance to pick up a few dollars while waiting for something better to turn up, the employees now take their positions with the idea of making them permanent.

Upon the motion of Mr. Goff a unanimous vote was cast as an expression of the gratitude felt by the members of the convention for the very kind, courteous and hospitable manner in which they had been entertained, especially by the ladies of the Entertainment Committee. A vote of thanks was also tendered to the Local Committee, to whom the delegates felt under obligation; another to the supply men for the magnificent exhibition they had given in St. Louis—one of the grandest displays of street railway supplies that had ever been made. Then followed a vote of thanks to the retiring president, vice-presidents and members of the Executive Committee for the efficient discharge of their duties, and the able manner in which they had conducted the affairs of the association during the year.

The president appointed a committee on Rules for Conductors and Motormen, consisting of Messrs W. F. Kelly, M. K. Bowen, E. C. Foster, Ira A. McCormick and H. H. Vreeland.

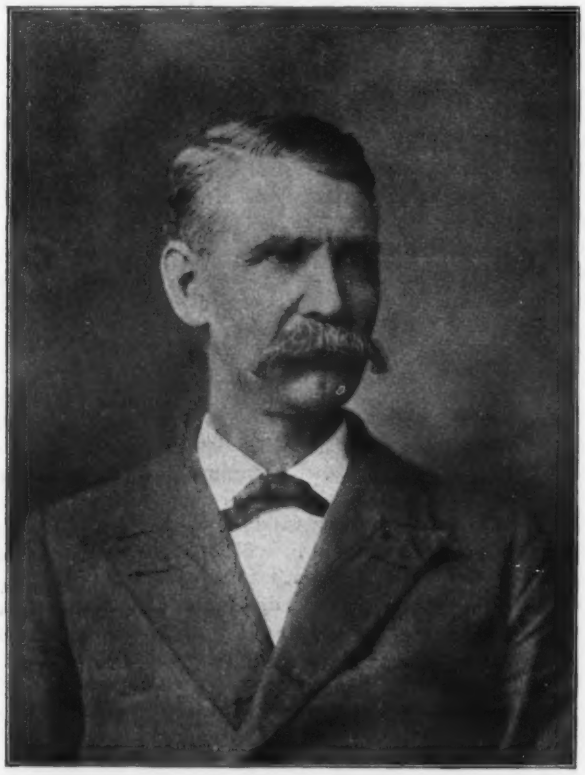
Mr. Lang then introduced the new president, Mr. Robert McCulloch, and expressed the hope that all would meet together again at Niagara Falls. President Littell then turned over the president's gavel to Capt. McCulloch, who said that if the new executive received the same cordial support as had his predecessors in the past, the association would certainly continue to prosper. The Executive Committee, he added, desire that all members shall write to the secretary, making suggestions for titles of papers for the next meeting.

The business of the meeting being over, the Convention then adjourned to convene at Niagara Falls on the third Tuesday in October, 1897.

The annual banquet on Thursday evening was a great success. Three hundred persons were present. The cuisine and floral decorations were of a high order. An orchestra discoursed music during the dinner, and in some of the more familiar refrains the company joined in singing. About 50 ladies graced the occasion and the speeches were exceedingly good. The following is a list of the toasts and the speakers: "City of St. Louis," Hon. Charles Nagle; "Welcome to Our Guests," Mr. F. N. Judson; "The Street Railway in the Courts," Mr. Smith P. Galt; "The Street Railway as a Social Factor," Mr. F. W. Lehmann; "The Press," Mr. W. M. Reedy; "The Technical Press," Mr. E. E. Higgins. Mr. J. H. Stedman acted as toastmaster.

The President of the American Street Railway Association.

The president of the American Street Railway Association, Capt. Robert McCulloch, is of Scottish lineage, his ancestors having settled in Virginia in the Colonial days, the paternal side in Amherst County and the maternal in Roanoke, the male members on both sides having been soldiers of the Revolution. He is a native of Rockbridge County, Va., and was educated at the Virginia Military Institution, at Lexington, Va. He went as a cadet in the Confed-



President Robert McCulloch.

erate service in April, 1861, and followed Gen. Lee until his surrender in April, 1865.

He went to St. Louis in 1869, and in 1871 entered the employ of the Bellefontaine Railway Company of that city as superintendent, was afterward made secretary, and then vice-president and general manager of the company. He continued in that service until 1889, when Mr. D. G. Hamilton and his friends purchased the Citizens', St. Louis, Cass Avenue, Northern Central and Union lines, and he was made vice-president and general manager of these roads, which position he now occupies.

Attendants.

Following is a list of delegates of members present:

Akron, O.—W. D. Chapman and C. A. Chapman, Akron Street Railway Company.

Atchinson, Kan.—J. A. Bendum, general superintendent Atchison Railway Light & Power Company.

Atlanta, Ga.—E. Woodruff and Thomas Elliott, C. E., Atlanta Consolidated Street Railway Company.

Augusta, Ga.—D. B. Dyer and R. J. McCarthy, Augusta Railway Company.

Baltimore, Md.—J. T. Hayward, S. B. Thompson, City & Suburban Railway Company; F. E. Tobe, Baltimore City Passenger Railway Company.

Bay City, Mich.—W. B. Morrison and A. S. Ashe, superintendent Bay City Consolidated Railway Company.

Boston, Mass.—C. S. Sargeant and J. E. Rugg, West End Street Railway Company.

Bridgeport, Conn.—Andrew Radel, Bridgeport Traction Company.

Brockton, Mass.—Charles S. Clark and A. A. Glasur, Brockton Street Railway Company.

Brooklyn, N. Y.—John L. Beins, Brooklyn City & Newtown Railroad Company; C. L. Rossiter and J. A. McCormack, Brooklyn Heights Railway Company.

Buffalo, N. Y.—H. H. Littell, Rob't E. Fryer and Rob't Dunning, Buffalo Railway Company; H. H. Littell, Burt Van Horn, Rob't L. Fryer, Buffalo & Niagara Falls Electric Railway Company.

Butte, Mont.—J. R. Wharton, Butte Consolidated Railway Co.

Camden, N. J.—J. Willard Morgan, Thos. P. Carley, J. Naramore and Henry J. Wesh, Camden, Gloucester & Woodbury Railway Company; Wm. S. Scull and W. E. Harrington, Camden Horse Railway Company.

Chicago, Ill.—H. M. Sloan, Calumet Electric Street Railway Company; F. R. Greene, T. C. Penington, M. K. Bowen, G. W. Knox, J. E. Moore, G. W. Price, A. C. Keidelberg, Rob't Stewart, R. L. Garth, P. A. and D. Hooton, Chicago City Railway Company; J. B Wesley, West Chicago Street Railway Company; B. J. Jones, superintendent South Chicago City Railway Company.

Cincinnati, O.—H. P. Bradford and B. J. Arnold, Cincinnati Inclined Plane Railway Company; B. L. Kily, Patrick Lew and John Harris, Cincinnati Street Railway Company.

Cleveland, O.—M. S. Robison, Cleveland Electric Railway Co.

Columbus, O.—W. F. Kelly, Columbus Street Railway Company.

Council Bluffs, Ia.—N. W. Wells and W. S. Dumwick, Omaha & Council Bluffs Railway & Bridge Company.

Davenport, Ia.—James F. Lardner, Tri City Railway Company.

Dallas, Tex.—W. H. Sinclair, Dallas Street Railway Company.

Derby, Conn.—W. B. Potter, Derby Street Railway Company.

Des Moines, Ia.—Geo. B. Hippee, J. S. Goodell and W. G. Owings, Des Moines City Railway Company.

Detroit, Mich.—Thos. Farmer and Chas. Remelins, Detroit Citizens' Street Railway Company.

Evansville, Ind.—R. L. Stockton, Evansville Street Railway Company.

Fall River, Mass.—Robert S. Goff, Globe Street Railway Company.

Findlay, O.—C. D. Kinney, Jacob Strader, J. A Bope and Chas. Smith, Findlay Street Railway Company.

Galveston, Tex.—Paul P. Young, Galveston City Railway Company.

Gerardville, Pa.—P. W. Ash, Schuylkiil Traction Company.

Hamilton, Ont.—J B. Griffith, Hamilton Street Railway Company.

Harrisburg, Pa.—F. B. Musser, Harrisburg Traction Company.

Hartford, Conn.—Wm. Grutien and E. S. Goodrich, Hartford Street Railway Company.

Hazelton, Pa.—H. Markle and G. W. Thompson, Lehigh Traction Company.

Houston, Tex.—A. H. Hayward, Houston City Railway Company.

Johnstown, Pa.—H. C. Evans, Johnston Passenger Railway Company

Kansas City, Mo.—C. F. Holmes, Martin H. Holmes and A. E. Siebert, Metropolitan Street Railway Company.

Lawrence, Mass.—W. P. Clark, Lowell, Lawrence & Haverhill Street Railway Company.

Lexington, Ky.—C. H. Stoll and R. T. Gunn, Belt Electric Line Company.

Lock Haven, Pa.—John A. Seely and H. H. Harrison, Lock Haven Electric Railway Company.

London, Ont.—C. E. A. Carr, London Street Railway Company.

Long Island City, N. Y.—George Chambers, Steinway Railway Company.

Louisville, Ky.—J. O. Haddox, T. J. Minary and W. T. Cook, Louisville Railway Company.

Lynn, Mass.—Col. J N. Cunningham, Lynn & Boston Railway Company.

Memphis, Tenn.—F. G. Jones and Frank Smith, Citizen's Street Railway Company.

Milwaukee, Wis.—C. D. Wyman, Milwaukee Street Railway Company.

Minneapolis, Minn.—C. G. Goodrich, Twin City Rapid Transit Company.

Mobile, Ala. —J. F. McAvinery, Mobile Street Railway Company.

Meriden, Conn.—N. H. Heft and William J. Stark, Meriden Street Railway Company.

Nashville, Tenn.—E. G. Connette, Geo. Swint and H. C. Burraugh, Nashville Street Railway Company.

Newark, N. J.—Andrew Radel, Newark & South Orange Horse Railway Company.

New Bedford, Mass.—E. E Potter and Chas. F. Shaw, Union Street Railway Company.

New Brunswick, N. J.—Andrew Radel, New Brunswick Traction Company.

Newburyport, Mass.—Charles Odell, James F. Shaw and H. Fisher Eldridge, Haverhill and Amesbury Street Railway Company.

New Haven, Conn.—G. A. W. Dodge, New Haven Street Railway Company.

New Orleans, La.—Frank R. Ford and Ralph L. Crump, Canal & Clairborne Railway Company.

New York, N. Y.—E. T. Landon, Dry Dock, East Broadway & Battery Railway Company; H. M. Littell and Thos. Millen, Metropolitan Street Railway Company.

Norwich, Conn.—Wm. S. Silver, Norwich Street Railway Company.

Newburyport, Mass.—Jas. F. Shaw and H. Fisher Eldredge, Newburyport & Amesbury Horse Railway Company.

Omaha, Neb.—W. A. Smith and F. A. Tucker, Omaha Street Railway Company.

Philadelphia, Pa.—A. Langstaff Johnston, Hestonville, Mantua & Fairmount Passenger Railway Company.

Pittsburg, Pa.—J. M. Tate, Jr., Federal Street & Pleasant Valley Passenger Railway Company; Henry Hubbard and E L. Rodes, Pittsburg, Allegheny & Manchester Traction Company; John Murphy, Second Avenue Passenger Railway Company.

Portland, Me.—W. R Wood, W. A. Wheeler, E. A. Newman and Frank M. Blaisdell, Portland Railway Company.

Philadelphia, Pa.—J. A. Brill, Manayunk & Roxborough Inclined Plane & Railway Co.

Quincy, Ill.—E. H. Stone, Jr., and J. F. Mare, Quincy Horse Railway & Carrying Company.

Racine, Wis.—L. E. Meyers, Belle City Street Railway Company.

Reading, Pa.—M. C. Autenbach and S. E. Rigg, Reading Traction Company.

Richmond, Va.—R. L. Williams, Richmond Traction Company; A. Langstaff Johnston, consulting engineer.

Rochester, N. Y.—F. Ruckling and J. H. Stedman, Rochester Railway Company.

Rockland, Me.—John F. Hill, O. O Gray and Thos. Hawkin, Rockland, Thomas Town & Camden Street Railway Company.

Salt Lake City, Utah.—W. P. Read, Salt Lake City Railway Co.

Springfield, Ill.—C. K. Minary, Springfield Consolidated Railway Company.

Springfield, O.—S. L. Nelson, Springfield Railway Company.

Springfield, Mass.—Wm. S. Loomis, Springfield Railway Co.

St. Joseph, Mich.—W. Worth Bean, St. Joseph & Benton Harbor Electric Railway & Light Company.

St. Louis.—D. G. Hamilton, Robt. McCulloch, C N. Duffy and Richard McCulloch, Cass Avenue & Fair Grounds Railway Company; J. S. Walsh, D. G Hamilton, Robert McCulloch, C. N. Duffy, Richard McCulloch, Citizens' Railway Company; Edward S. Whitaker, Geo. W. Baumhoff, James Adkins, Lindell Railway Company; P. C. Maffitt, Missouri Railway Company; John Mahony and Charles Green, People's Railway Company; Joe S. Minary and John C. Allen, Southern Electric Railway Company; R. Lehman, St. Louis & Suburban Railway; D. G. Hamilton, Christian Peper, R. B. Jennings, Robert McCulloch, Richard McCulloch, St. Louis Railway Company; John Scullin, Harry Scullin, Thomas W Murphy, Charles H. Pierson and John P. Gilbert, Union Depot Railway Company

St. Paul, Minn.—C. G. Goodrich Twin City Rapid Transit Company.

SYRACUSE, N.Y.—Matthew Murphy, Syracuse Street Railway Company.
TAUNTON, MASS.—Geo. F. Siebel, Taunton Street Railway Company.
TOLEDO, O.—Albion E. Lang, E. J. Buchtel and C. N. Hart, Toledo Traction Company.
TRENTON, N. J.—Chas. Y. Flanders and R. H. Beach, Trenton Passenger Railway Company (Consolidated).
TROY, N. Y.—C. H. Smith and J. H Jones, Troy City Railway Company.
WASHINGTON, D. C.—James B. Adams, Columbia Railway Company.
WHEELING, WEST VA.—Michael Loftus, Wheeling Railway Company.
WILKES BARRE, PA.—J. C. Friexill, Wilkes Barre & Wyoming Valley Traction Company.
WILLIAMSPORT, PA.—Ernest H. Davis, J. W. Cochran, Williamsport Passenger Railway Company.
YOUNGSTOWN, O.—A. A. Anderson, Mahoning Valley Electric Railway Company.

Among the Exhibitors.

W. H. COE, Providence, R. I., exhibited gold, silver and platinum leaf in roll forms.

MR. R. J. BELLAMY exhibited a vestlette to be used by conductors for change and tickets.

MR. E. T. DE WITT, of Lansingburgh, N. Y., had on exhibition the de Witt common-sense sand box.

THE WELLS & FRENCH COMPANY, Chicago, Ill., showed the well-known Chicago truck of its manufacture.

THE ELECTRIC MUTUAL CASUALTY ASSOCIATION had a booth and was represented by Mr. Newton Jackson.

THE MISSOURI TELEPHONE COMPANY, St. Louis, Mo., had its interests well looked after by its president, Mr. D. A. Kusel.

THE NEW YORK CAR WHEEL WORKS, Buffalo, N. Y., exhibited a line of machined car wheels and axles. R. J. Mercur was in charge.

THE INTERNATIONAL REGISTER COMPANY, Chicago, Ill., represented by Mr. H. H. Woodworth, showed several types of fare registers.

THE AKRON INSULATOR & MARBLE COMPANY, represented by Mr. A. L. Daniels, exhibited various lengths of vitrified insulating tubes.

THE TAYLOR ELECTRIC TRUCK COMPANY, Troy, N. Y., showed types of its excellent single and radial trucks. A. T. Reynolds was in charge.

BRODERICK & BASCOM, St. Louis, Mo., exhibited a large steel cable to be used on one of the city street cable lines. J. J. Broderick was in attendance.

THE MASON ELECTRIC EQUIPMENT COMPANY, Chicago, Ill., showed overhead railway equipments, poles, brackets, etc. W. R. Mason was in attendance.

THE STEVER RAIL JOINT COMPANY, of Canton, O., exhibited its jaw clamp rail joint. Mr. L. B. Collins, secretary, and Mr. Geo. Stever were in attendance.

J. M. ATKINSON & COMPANY, Chicago, Ill., exhibited their horseshoe rail bond and drilling machine. Mr. Atkinson was present to represent the company.

THE ST. LOUIS REGISTER COMPANY, St. Louis, Mo., showed a line of its security fare registers. J. A. Stephenson and E. F. Wickham represented the company.

THE MEAKER MANUFACTURING COMPANY, North Chicago, Ill., showed a line of fare registers. J. W. Meaker and Guy L. Meaker looked after the company's interests.

EXHIBIT OF THE PARTRIDGE CARBON COMPANY.

GEO. P. JONES & CO., St Louis, showed an extensive line of samples of "Peerless" oils and greases for electrical purposes. Mr. Jones was in charge of the exhibit.

WM. WHARTON, JR., & CO., Philadelphia, Pa., exhibited the Wharton unbroken main-line track and frogs. George R. Olshausen and E. P. Howell were in attendance.

MR. D. C. SWEET, of Springfield, Mass., exhibited his car-wheel grinding machinery, consisting of emery wheels for trueing up car wheels without removal from the car.

THE MARK RAILWAY EQUIPMENT COMPANY, Chicago, Ill., exhibited sections of rails, rail chairs, double-brace chairs, tie-plates and pole-arms. C. E. Mark was in attendance.

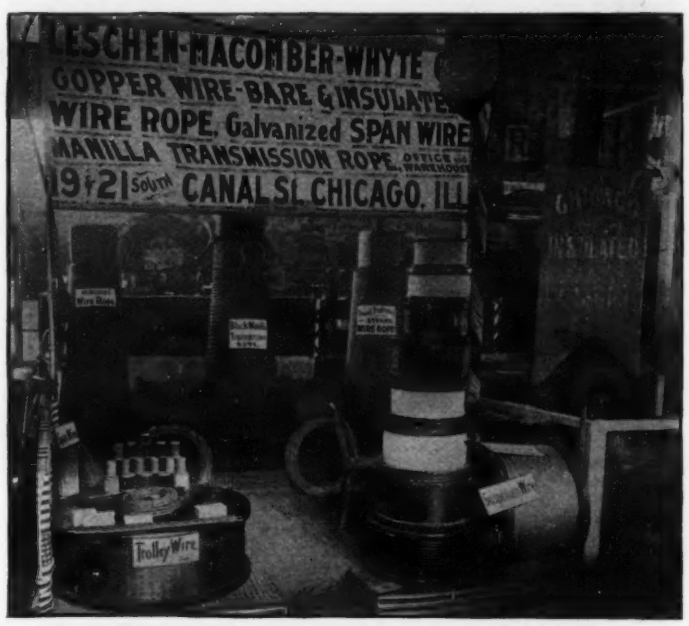


EXHIBIT OF THE LESCHEN-MACOMBER-WHYTE COMPANY.

MR. HENRY A. HARTMAN, Philadelphia, Pa., exhibited the Hartman improved adjustable street car hand straps and also a working model of an electrically operated track switch.

MORRELL ELECTRIC WORKS, St. Louis, Mo., had on exhibition several types of built-up commutators ready for adjustment. A. W. Morrell and W. A. Ferguson were in attendance.

THE CONSOLIDATED CAR FENDER COMPANY, Providence, R. I., had several of its spring fenders on exhibition. The company was represented by Col. A. C. Woodworth and Mr. G. H. Hale.

THE R. D. NUTTALL COMPANY, Pittsburg, Pa., showed a full line of its gears, pinions and trolleys. The company was represented by Messrs. F. A. Estep, Arthur S. Partridge and E. P. Sharp.

THE FITZGERALD-VAN DORN COMPANY, Chicago, Ill., showed its automatic street and elevated car coupling, made in seven sizes. Mr. W. E. Van Dorn was in charge of the exhibit.

EXHIBIT OF THE COMMERCIAL ELECTRICAL SUPPLY COMPANY.

THE PAIGE IRON WORKS COMPANY, Chicago, Ill., displayed several types of street track crossings and fittings. The company was represented by Messrs. Alonzo W. Paige and E. S. Nethercut.

THE DUFF MANUFACTURING COMPANY, Allegheny, Pa., manufacturer of

track and oil well jacks, exhibited car jacks of the lifting and track type. Mr. G. A. Urling represented the company.

The National Water-Tube Boiler Company, whose main office is in New Brunswick, N. J., exhibited a model of its type of boiler, which the company states has met with an extensive sale.

The Elliot Frog & Switch Company, East St. Louis, Ill., had on exhibition Elliot's patent steel rail, frogs and crossings. H. Elliott, H. Elliott, Jr., and W. H. Elliott represented the company.

The Hale & Kilburn Manufacturing Company, Philadelphia, Pa., exhibited walk-over and reversible car seats. Mr. H. T. Bigelow and Mr. C. E. Barrett represented the company.

Exhibit of the Central Union Brass Company and Washburn & Moen Company.

Mr. R. H. Ham, Troy, N. Y., exhibited the Ham patent sand box for cable and electric railways, the Windsor emergency brake, and represented also the Trojan Button Fastener Company, Troy, N. Y.

The Mississippi Glass Company, St. Louis, Mo., showed a line of figured roll glass for deck lights in cars and wire glass for sky-lights; rough and ribbed glass and fire brick. J. A. Ledwick was in attendance.

The American Steel Foundry Company, St. Louis, Mo., showed a line of street-car castings and also a piece of steel cast in the form of a silver dollar, weighing 100 pounds and having a market value of $1.

"Smith of New York," represented by Mr. Thos. C. Millen, exhibited electric and oil headlights, clusters and combination lamp fixtures, candle and oil bracket lamps and a general line of street railway supplies.

Linburg, Sickel & Co., Trenton, N. J., exhibited the Trenton trolley wagon. This wagon offers means of repairing trolley wires without stopping traffic and may also be used for supporting hose in case of fire.

K. McLennan & Company, Chicago, Ill., exhibited "the only article that will prevent sparking and cutting," viz: Gale's commutator compound. Mr. J. Isaacs, business manager, was in charge of the exhibit.

Exhibit of the Ohio Brass Company.

The Hart & Hegeman Manufacturing Company, Hartford, Conn., exhibited a new railway switch for car heaters and electric lights. The exhibit was in the charge of Mr. George S. Searing, of the Chicago office.

The Columbia Machine Works, Brooklyn, N. Y., exhibited a line of electric railway supplies and drop-forged copper commutator bars, car trimmings and brass castings. The exhibit was in the charge of Mr. J. G. Buehler.

The Pond Machinery Company, St. Louis, Mo., exhibited the Pond steam separator, which it is guaranteed will relieve the steam of entrained water and still not cause any reduction of pressure between boiler and engine.

The National Lead Company, New York and St. Louis, exhibited a line of babbitts and solders, paints and white lead and special solder for electrical purposes. Mr. Arthur Bengel, of the St. Louis office, was in charge of the exhibit.

Part of Exhibit of the J. G. Brill Company.

The New Haven Car Register Company, New Haven, Conn., showed a full line of its standard single, double and triple registers. The exhibit was in the charge of Mr. F. Coleman Boyd, and Mr. A. N. Loper was in attendance.

The Taunton Locomotive Manufacturing Company, Taunton, Mass., represented by Wendell & MacDuffie, New York City, exhibited in front of the Auditorium one of the Taunton electric snow plows. Jacob Wendell, Jr., was in attendance.

The Hyatt Roller Bearing Company, Newark, N. J., exhibited the Hyatt flexible roller bearings for the reduction of friction on all kinds of revolving machines. Mr. F. V. M. Hudson, secretary of the company, was in charge of the exhibit.

Mr. Ezra H. Linley, St. Louis, Mo., represented by Mr. A. F. Zell, had an exhibit of rails and rail fasteners, bare and insulated wire, car spring and track tools, machine screws and a general supply of street railway and car equipments.

The Safford & Moore Railway Jack Company, Chicago, Ill., showed two styles of jacks, one a raising and automatically lowering jack, the other a quick-tripping track jack. Mr. M. M. Moore and Mr. N. W. Williams were in attendance.

The Cutter Electrical & Manufacturing Company, Philadelphia, Pa., represented by Mr. W. E. Harrington, displayed a line of its admirable automatic magnetic circuit-breakers, switches, etc., for switchboards and cars, which have met with so much success.

McRoy Terra-Cotta Conduit Exhibit.

The H. B. Camp Company, Aultman, O., exhibited samples of vitrified underground conduit, both single and laid in sections, with a large section supported at the ends to show its sustaining qualities. Mr. A. L. Daniels was in charge of the exhibit.

THE KINZER & JONES MANUFACTURING COMPANY, Pittsburg, Pa., showed its Kinzer brake shoes and connections. These shoes, instead of being cast of one metal, are of the composite filled type. The exhibit was in the charge of Mr. William Weierbach.

THE ADAMS & WESTLAKE COMPANY, Chicago, Ill., exhibited a line of car curtains, brake handles, car trimmings and street railway arc lamps. The company was represented by Messrs. William S. Bartholomew, F. B. Jones, H. E. Keeler and L. A. Gray.

THE MISSOURI CAR & FOUNDRY COMPANY, St. Louis, Mo., exhibited a full line of chilled steel street car wheels and brake shoes; also cable-pulleys and brass journal boxes. The company was represented by Mr. James Conully, general superintendent.

THE JOHNSON COMPANY, Johnstown, Pa., and Lorain, O., made an extensive display of its standard rails, crossings and frogs. The representatives of the company were: H. C. Evans, E. A. Mysenbury, W. W. Kingston, A. S. Littlefield, O. C. Evans.

CHAPMAN VALVES were exhibited by the L. M. Rumsey Manufacturing Company, St. Louis agents. Mr. E. L. Ross, sales agent for the Chapman Valve Manufacturing Company, Indian Orchard, Mass., was also present and circulated among the delegates.

THE GOLD STREET-CAR HEATING COMPANY, New York and Chicago, exhibited a line of its known electric car heaters; also hot-water circulating street-car heaters, as used on the Broadway line, New York. The exhibit was in the charge of Mr. E. H. Gold.

THE JEWELL BELTING COMPANY, Hartford, Conn., had its usual interesting exhibit of large and small leather belts; the display was in charge of Mr. Charles E. Newton, secretary of the company, assisted by Messrs. W. G. Wheelock and A. E. Silk.

THE Q. & C. COMPANY, Chicago, exhibited its metal saws, which attracted much attention; also a variety of its other well-known specialties, such as oil filters, wood-preserving oil, tie plates, etc. Mr. H. D. Gordon and Mr. E. W. Hodgkins represented the company.

pounds. The company also showed a complete line of blow-off valves, pop safeties and small brass valves for power stations.

MR. JOHN T. MCROY, Chicago, Ill., displayed the McRoy vitrified terra cotta conduit of 2, 3, 4 and 6 duct, each section being six feet long. Mr. McRoy was extremely well pleased with the reception which his conduit received, and it certainly did attract much deserved attention.

THE NEW YORK BELTING & PACKING COMPANY, LIMITED, New York City, showed a full line of mechanical rubber goods, moulded work, interlocking rubber tiling for street cars, vulcan-packing and vulcanite emery wheels. The exhibit was in the charge of Mr. A. G. Francis.

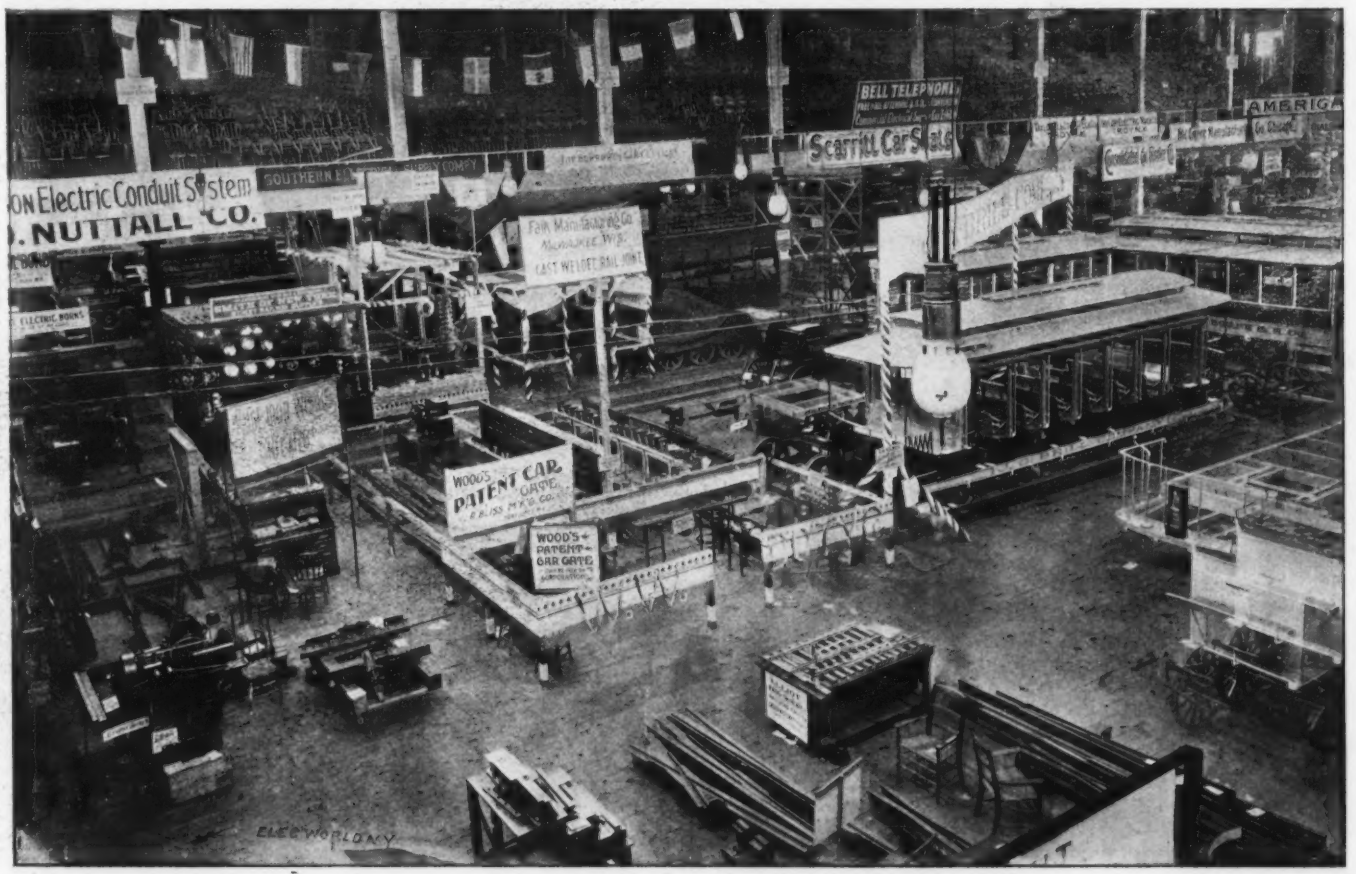
THE LESCHEN-MACOMBER-WHYTE COMPANY, Chicago, Ill., exhibited black manila transmission rope, trolley, weatherproof and magnet wires, galvanized span wires and patent flattened strand wire rope. The exhibit was in the charge of Mr. George S. Whyte and Mr. F. B. Macomber.

MISSOURI CAR & FOUNDRY COMPANY, St. Louis, Mo., showed a line of turned and finished cold drawn car axles, lathe turned Glendon axles and soft steel spikes and Goldie tie plates of Dilworth, Porter & Co., Ltd., Pittsburg, Pa. Mr. A. Morrison of the latter company was in attendance.

THE SHICKLE, HARRISON & HOWARD IRON COMPANY, St. Louis, exhibited a line of cast steel gear-wheels, and steel castings for railways. They also showed gear-wheels in different stages of construction. The exhibit was in the charge of Mr. James Daniels, secretary of the company and Mr. John M. Harrison.

THE JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., exhibited the Columbia rail bond, which has met with so much success. The company was represented by Mr. Henry L. Shippy, of the New York office; Mr. G. C. Bailey and Mr. A. B. Conover, of the Chicago office, and Mr. W. L. Doyle, of the Trenton works.

THE FALK MANUFACTURING COMPANY, Milwaukee, Wis., exhibited samples of the Falk cast-welded rail joint. This type of joint has become very popular with street railway managers, and has received an exten-



GENERAL VIEW OF EXHIBITS.

THE FOREST CITY ELECTRIC COMPANY, Cleveland, O., also of New York City, showed a full line of roll drop and drop forged commutator bars; also protected rail bonds and bond welders. The exhibit was in the charge of Messrs. W. B. Cleveland and John C. Dolph.

THE ST. LOUIS CAR COMPANY, St. Louis, Mo., exhibited its well-known double trucks, some of them being equipped with Westinghouse motors and Verstraete electric brakes. The St. Louis truck is not without honor in its own city, for there are 400 of them in use there.

THE CRANE COMPANY, Chicago, Ill., represented by Mr. G. A. Hurd, had a large exhibit of its well-known gate and other valves, several of very large size, one being a 24-inch gate valve for a steam pressure of 250

sive application in St. Louis alone. Mr. Clements C. Smith, E. A. W. Wister, Henry L. Prather represented the company.

THE HUNTER AUTOMATIC FENDER COMPANY, Cincinnati, O., represented by the president of the company, Mr. Lytle J. Hunter, exhibited the Hunter fender, the Hunter rotary brush rail sweeper, and an ingenious illuminated car sign which can be used in connection with either gas or electricity. The sign attracted a great deal of attention.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY, Chicago, Ill., exhibited a new type of telephone switchboard containing 100 drops, also a new type of long-distance telephone power generator; a 40,000-ohm magneto transmitter and several photographs of various exchanges which the company recently installed. Mr. Charles P. Platt was the representative.

The McGuire Manufacturing Company, Chicago, Ill., displayed several McGuire trucks, one of which was mounted with two General Electric 50 motors, the type to be used for the Brooklyn Bridge service. The company also showed its well-known pivotal motor trucks. Mr. M. G. Hubbard and Mr. C. F. Collins were in attendance.

The M. M. Buck Manufacturing Company, St. Louis, Mo., exhibited a line of headlights, both oil and electric; motor and grip car lamps, Shelton oil filters, Joyce jacks, patent curtain attachments and leather belting. Also a full line of track tools and railway supplies. W. P. Marshall, E. W. and A. N. Handlan represented the company.

The Leonhardt Wagon Manufacturing Company, Baltimore, Md., exhibited three of its electrical emergency tower wagons, having elevated side projecting platforms, so that there is no delay to traffic while work on the overhead equipment is in progress. The company was represented by Messrs. McIvers and R. H. M. McClernan, of Baltimore.

The Partridge Carbon Company, Sandusky, O., exhibited a full line of its self-lubricating motor and generator brushes. This company, as is well known, makes a specialty of motor and generator brushes, in which it does a very large business. It has agencies in all the large cities. Mr. J. S. Speer, secretary of the company, was in charge of the exhibit.

The National Carbon Company, Cleveland, O., exhibited motor brushes, electric light arc carbons; also 3-inch smelting carbons, 52 inches long; a full line of telephone back plates, diaphragms and lightning arresters; Hayden No. 2 battery cells and the Fuller battery. The exhibit was in the charge of Mr. M. M. Hayden and Mr. R. O'Connor.

The Munson Electric Conduit Company, Chicago, Ill., had on exhibition a small working model of the Munson electric conduit system for street car propulsion. This system is applicable to existing cable conduits, elevated and steam railways. The company was represented at the Auditorium by Mr. William F. Roberts and Mr. John H. Munson.

The Brownell Car Company, St. Louis, Mo., had one of its double-truck high-speed cars on exhibition. It was of the one-door accelerator pattern, 26 feet in length and mounted on Brill trucks with Barr wheels. The platforms have gates operated from the opposite end of the car The interior finish was in cherry. This was one of the first cars on exhibition.

The Electric Insulating Company, St. Louis, Mo., showed its "Peerless" armature compound, which when applied in the form of a paint becomes hard, thereby holding the armature wires firmly in place. It is claimed that by the use of this compound, mica and cloth may be done away with entirely in the winding of armatures. Samuel J. Stein represented the company.

The Phœnix Carbon Manufacturing Company, St. Louis, Mo., exhibited its new 1896 process motor brushes, also its specialties in battery materials, electric light carbons and telephone parts; also a line of carbon battery cylinders, carbon lightning arresters, carbon discs and filament blocks. The exhibit was in charge of Col. S. G. Booker, superintendent of the company, and Mr. H. L. Page.

The Kraushaar Lamp & Reflector Company, St. Louis, Mo., had on exhibition a large board which displayed in a neat manner its many styles of street car trimmings. The company is sole manufacturer of the St. Louis electric headlight and the Kling ratchet brake handle. The exhibit was in the charge of Mr. Al. Mynders. C. F. Kraushaar and F. J. Elbing were also in attendance.

The Heine Safety Boiler Company, St. Louis, Mo., represented by Mr. C. D. Merton and Mr. Russell T. Walker, had an exhibit of a 50-hp boiler and a model of a 200-hp boiler. Also a full-sized sample water leg, showing methods of staying and cleaning and workmanship. The model was painted with gold paint, thus indicating "the only standard." Adolphus Meier and H. C. Meinholtz were also in attendance.

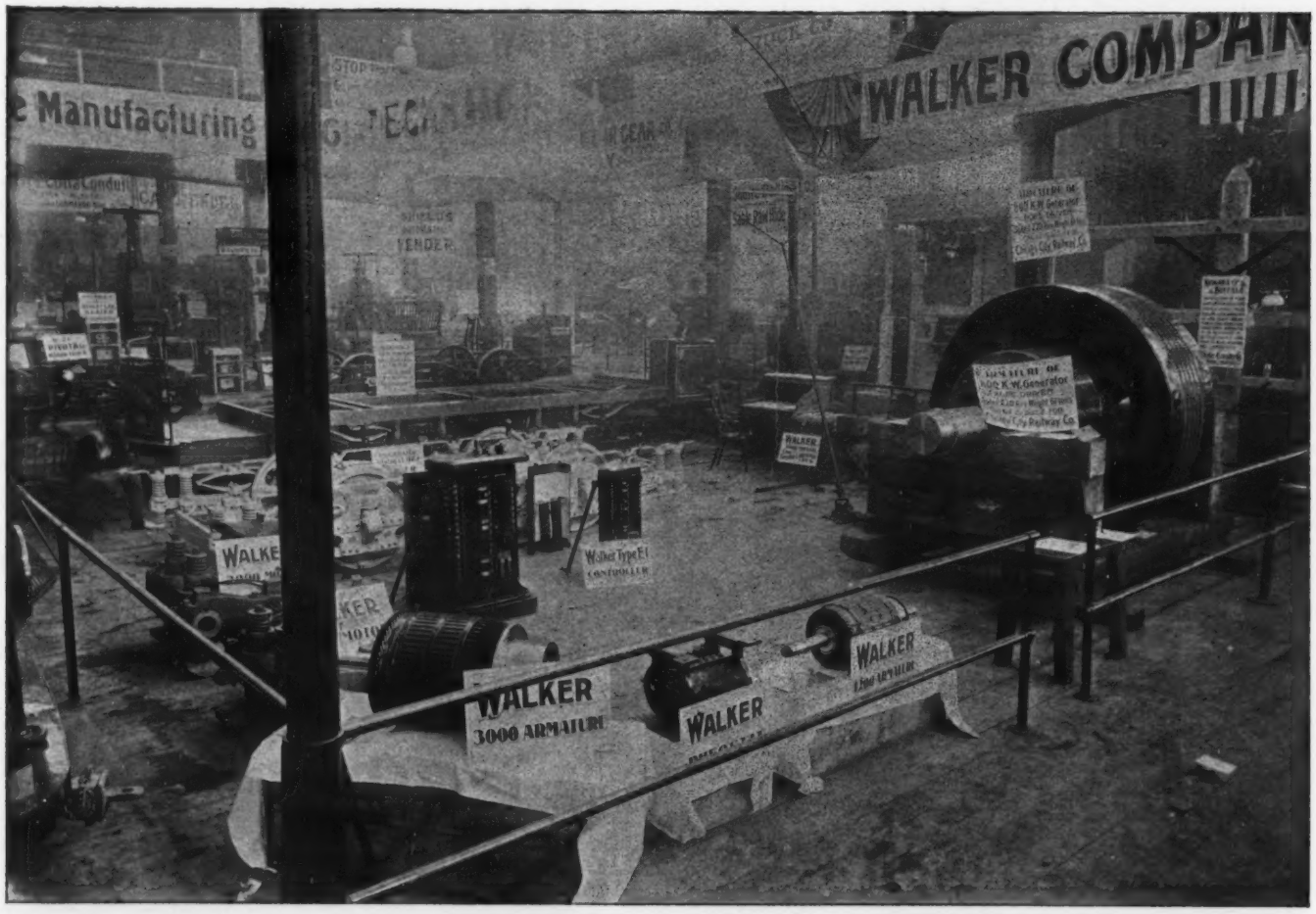


Exhibit of the Walker Company.

The Consolidated Car Heating Company, Albany, N. Y., exhibited its electric heating apparatus and temperature-regulating switches. Several heaters, including switches, were placed under car seats to show their actual operation. The exhibit was in charge of Mr. W. P. Cosper. the Chicago representative, and Mr. H. N. Ransom, Eastern sales agent.

The Chicago Insulated Wire Company, Chicago, Ill., represented by Mr. William M. Smith, secretary and treasurer, exhibited a line of weather-proof wires and cables, and all sizes of line and feeder wires up to 500,000 circular mils; also a pyramid of wire reels of magnet and annunciator wire. The souvenir consisted of a small spool of silk magnet wire.

The Edison-Brown Plastic Rail Bond was exhibited by Messrs. Trittle and Fuller, St. Louis, Mo., representing Mr. Harold P. Brown, of New York City. Mr. Brown was also present during the Convention. The exhibit consisted of samples of plastic rail bonds, plastic cup bonds and plastic plug bonds, also Edison solder for brightening surfaces and giving better contact. Mr. Brown's Western trip proved most successful.

The American Car Company, St. Louis, Mo., showed three splendidly finished cars, just finished for one of the New Orleans street railways. The company manufacture cars for street, elevated and suburban traffic, and were represented in the convention by Messrs. William Sutton, president; Theophile Papin, vice-president; Ferdinand Meyer, second vice-

president; Emil Alexander, secretary, and Edward J. Lawless, Eastern agent.

W. W. DOTY & Co., New York, exhibited their automatic electric street switch. The exhibit consisted of a full size working model and inasmuch as it was the only purely electric switch shown, it attracted a great deal of attention. This switch seems to be a solution of the problem of automatically turning street switches. Mr. W. W. Doty was present to represent the interests of the firm.

THE CONSOLIDATED CAR FENDER COMPANY, Providence, R. I., exhibited the Providence fender. The company reports that out of a total number of 219 accidents, the Providence fender saved the lives of 97 per cent., and 99 per cent. of these were not injured. The fender consists of an elastic projecting cradle cushioned with rubber rolls and is dropped at the will of the motorman by a foot push-button and can be again raised without stopping the car.

THE H. W. JOHNS MANUFACTURING COMPANY, New York City, also of Chicago, Boston, Philadelphia and London, exhibited a line of its well-known electrical materials, including moulded mica trolley line insulators, weather-proof sockets, vulcabeston controller parts, field spools, bushings, electric car heaters and electro-therms. The exhibit was in the charge of Mr. J. Emory Meek, and Messrs. E. B. Hatch and J. H. McClernan were in attendance.

THE WEBER RAILWAY JOINT MANUFACTURING COMPANY, New York City, exhibited samples of joints used on both 6-inch and 9-inch girder rails and on high T-rails. Also samples of joints used on both the New York and Chicago elevated roads; insulated joints for track circuits in signaling and step joints for connecting rails of different heights. The company was represented by Mr. G. A. Weber, vice-president, and Mr. Percy Holbrook, engineer of the company, and D. O. Ward.

a full line of material for suspending figure 8 trolley wire; strain insulators, both of the hard rubber and patent compound "Dirigo" types; feeder wire splices and insulators and flexible pole brackets. The exhibit was in the charge of Mr. C. K. King, secretary of the company, assisted by Mr. Arthur L. Wilkinson.

THE SHULTZ BELTING COMPANY, St. Louis, Mo., exhibited its patent sable rawhide belting, patent woven leather link belt and the Shultz pulley covering. Capt. J. A. J. Shultz, president of the company, was in evidence during the Convention. The Shultz Belting Company is doing a large business with street railway as well as with lighting companies, not only in this country but abroad. Its belting is in extensive demand as far away as Denmark, Sweden and Russia, many of the larger orders coming by cable. Ed. B. Shultz, John R. Shultz, B. C. Alvord, Harry J. Alvord and J. A. Ferguson were in attendance.

THE STANDARD AIR BRAKE COMPANY, New York City, exhibited both direct and geared axle driven and independently driven air compressors together with the remaining portions of brake equipments, such as tanks, brake cylinders and sundry fittings. The motor-driven compressor formed a unique feature of the exhibit, and was shown in operation. This equipment automatically maintains a uniform pressure in the reservoir, the motor being started and stopped by a rheostat and controller, as the air is used. Mr. E. J. Wessels, general manager of the company, and Mr. H. P. Merriam, chief engineer, were in attendance.

THE BETHLEHEM IRON COMPANY, Bethlehem, Pa., exhibited a large engine shaft which is to form part of a direct-connected circuit for the Northwestern "L" road in Chicago. The generator, built by the Siemens & Halske Company, will have an output of 1500 kilowatts, and is one of four such units. Four more of similar design have been ordered by the Union Loop Railway in Chicago and four by the Chicago City Railway Company. The shaft, which is a hollow steel forging, is 28 inches outer diam-

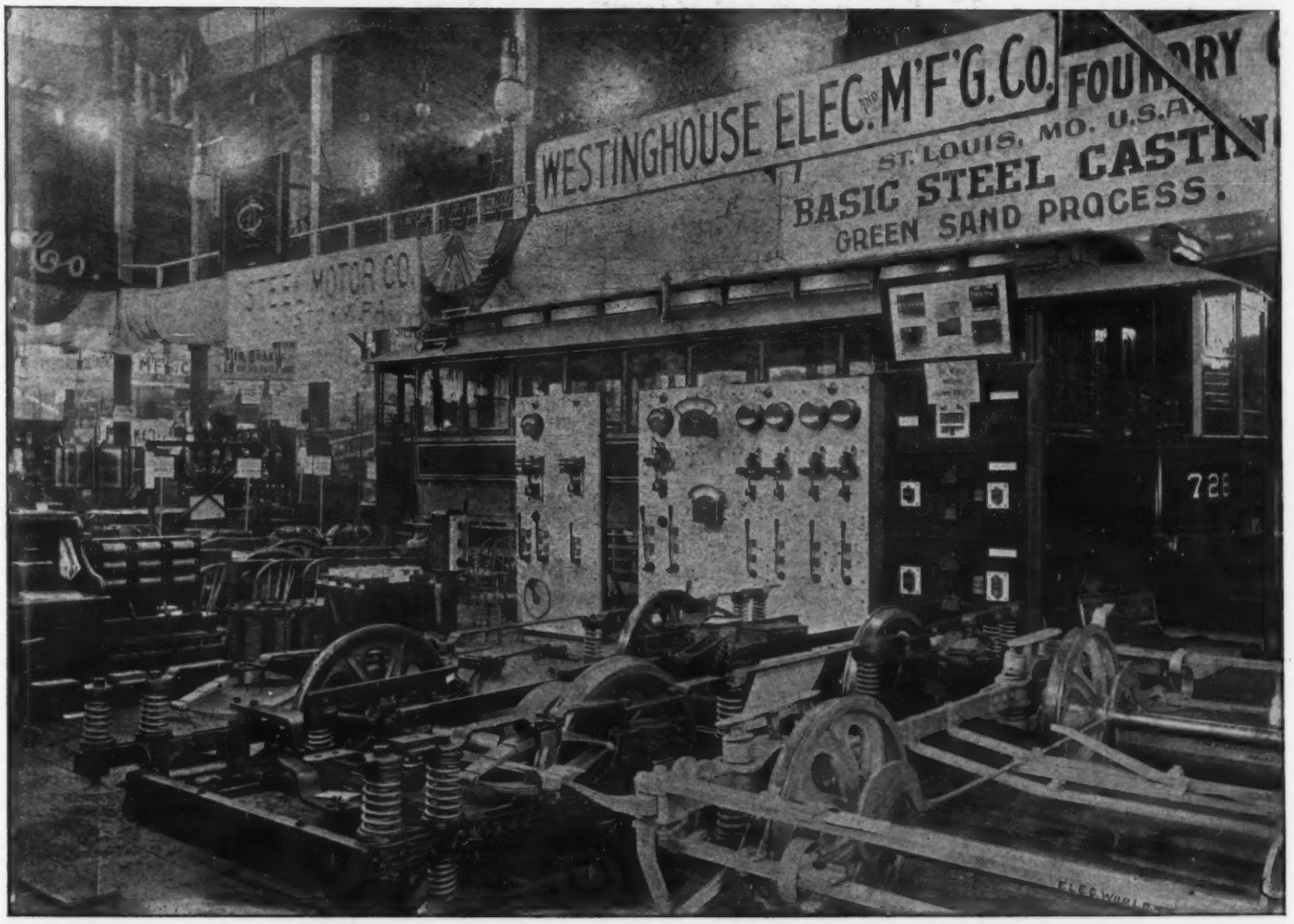


EXHIBIT OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.

THE CREAGHEAD ENGINEERING COMPANY, Cincinnati, O., showed a full line of flexible brackets and overhead line materials, including iron pole fittings and malleable iron cross-arms. The company also had on exhibition a number of long life Manhattan arc lamps, run in series on the street railway circuit; a 110-volt direct-current and 100-volt alternating-current lamp and one of the 110-volt direct-current junior type. The exhibit was in the charge of Mr. G. R. Scrugham, superintendent of the company.

THE OHIO BRASS COMPANY, Mansfield, O., showed a complete line of overhead materials, bell metal bearings, adjustable track brush holder and track brushes, a wide variety of hanger bodies, 10 different styles of ears,

eter at the centre, 22 inches at the journals and 11 inches inside. It is 22 feet 6 inches long and weighs 15 tons. Mr. H. F. J. Porter, Western representative, was in charge of the exhibit.

THE STANDARD UNDERGROUND CABLE COMPANY, of Pittsburg, also of New York, Chicago and St. Louis, had a neat exhibit in charge of its Western manager, Mr. J. R. Wiley, assisted by Mr. Frank Clark Cosby. The display consisted of samples of both underground and aërial cables also submarine rubber insulated feeder cables and paper, fibre, and rubber insulated cables. The company will open an office in St. Louis, as owing to the recent ordinance requiring all wires placed underground in the city of St. Louis, an extensive business is expected

in that locality. Mr. Cosby, who has been connected with Mr. Wiley as superintendent of construction for the Western territory, will have charge of the St. Louis branch.

The Central Union Brass Company, St. Louis, Mo., exhibited a 6x9 foot sample board of brass fittings for street cars, besides overhead material of various kinds. The company also represented the Washburn & Moen Manufacturing Company, and showed samples of that company's magnet wire, reels of lead-covered cable and No. 000 figure 8 trolley wire; also a section of a large standard cable of 2,792,000 circular mils, and a full line of samples of rubber-covered "Crown" brand cables, lamp cord, standard overhead feeders, submarine telephone cables and Chicago rail bonds. Mr. C. H. May, of St. Louis, was in charge of the exhibit. The Washburn & Moen interests were represented by F. H. Daniels and Lewis Critten.

The Mica Insulator Company, of New York, also of Chicago and London, had on exhibition a large variety of the various forms of its well-known insulation "Micanite." The booth, occupying 100 square feet of space, and lighted by an arc lamp, was handsomely decorated under the personal supervision of the company's St. Louis representative, Mr. Arthur S. Partridge. Some of the most prominent forms of insulation shown were commutator segments and rings for all the standard railway motors and many of the standard makes of power generators; also micanite plates, field spools, armature slot troughs, armature discs, washers, tubes, "Micanite" and "Empire" insulating cloths and papers, etc. A large water-power armature, insulated throughout with "Micanite," deceived a good many. Although made of wood it closely resembled a genuine armature.

Eugene Munsell & Co., miners and importers of mica, of New York and Chicago, with agencies in the principal cities, had an elaborate display of India and amber mica, some of it in sheets as they get it direct from the mines. They also exhibited a full line of drop forged copper commutator segments and various types of street railway motor commutator segments, and a full line of mica for electric purposes. The blotters distributed on the writing desks of the hotels and at the places of registration in the Convention hall did effective work, as they impressed upon the visiting delegates the fact that the mica came from the mines strapped on the backs of burros or mules. The little mica souvenir given away was well received. Many were seen wearing them in the lapel of their coats. The exhibit was in the charge of Mr. Henry C. Onick, of the Chicago office, who also represented the Mica Insulator Company.

The Peckham Truck exhibit was one of the most extensive at the Exposition. Aside from the space which it occupied in the exhibits of the Walker Company, the Westinghouse, General Electric, and Brooklyn & New York Railway Supply Company, there was a No. 7-C Excelsior truck fitted with Kilgour emergency brake and G. E.-1000 motors; an "extra long" truck with Westinghouse No. 38-B motors; a standard No.8-A truck with new type extension trusses and a No. 14 double cushioned swivel truck. There was also in operation on the street railways in St. Louis a pair of No. 14 double trucks, equipped with G. E.-1200 motors. Hunt air brakes and Jackson & Sharp 35-foot vestibuled combination car body, the bottom of the sills of which were but 27½ inches above the track. At the Peckham headquarters in the Southern Hotel was a small aluminum model. Mr. Edgar Peckham, president, Mr. W. E. Cooke, general manager, Mr. J. A. Hanna, Chicago agent, and Mr. A. W. Field, Boston representative, were in attendance.

The Walker Company made a splendid display of its electric railway apparatus, the most prominent feature being a 800-kw rope-driven generator armature, belonging to one of the 12 machines to be constructed for the Chicago City Railway Company. Each of these machines when complete will weigh 61 tons, the armature alone weighing 14 tons; the company had also on exhibition its latest type 75-hp railway motor with series-parallel controller; as well as a 50-hp, a 35-hp and a 25-hp, each with controller; and extra armatures for the motors, showing the different methods of winding employed by the company. Two 25-hp motors were shown mounted with the Walker spring suspension on Peckham extra long 6-E trucks. The new Walker trolley and overhead material formed an interesting and important feature of the exhibit. The company was represented by Mr. J. Holt Gates, Western agent, assisted by W. J. Davison, engineer from the Cleveland works, and Mr. S. T. Dodd. Mr. W. H. Bone,

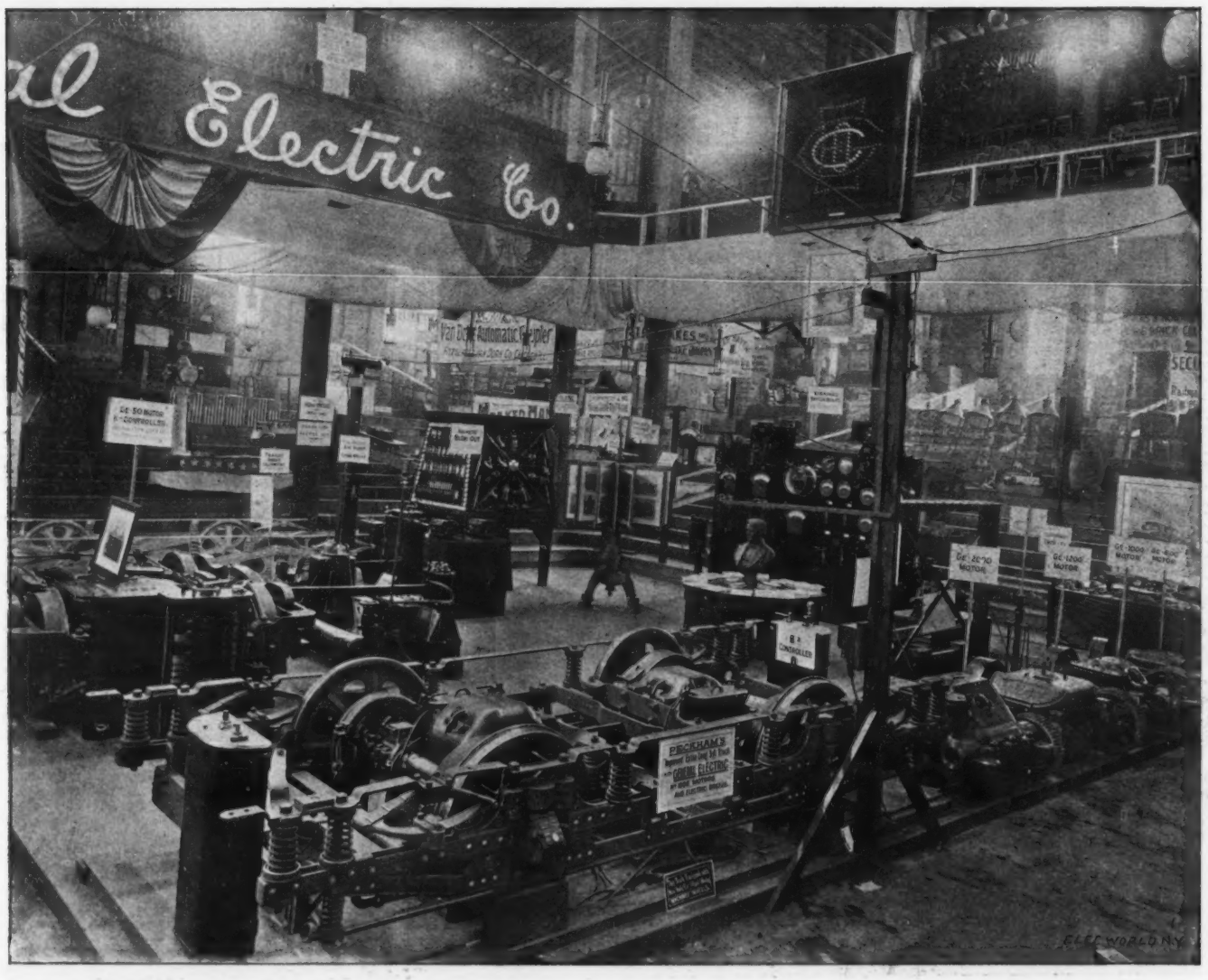


Exhibit of the General Electric Company.

manager, Mr. M. D. Barr, general sales agent, and Mr. I. C. Flynn were also present.

THE COMMERCIAL ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., had a very elaborate exhibit representing the Bryant Electric Company, lighting supplies; Clifton Manufacturing Company, friction tape; Electrical Engineering & Supply Company, Western Electric Company and W. T. C. Macallen, street railway supplies; Holmes, Booth & Haydens, K. K. weatherproof wire; Hugo Reisinger, "electra carbons"; the India Rubber & Gutta Percha Insulating Company, Habirshaw wires; Pass & Seymour, porcelains; Perkins Electric Switch Manufacturing Company, switches, lamps, etc.; Standard Paint Company, P. & B. products; Wagner Electric Manufacturing Company, transformers, switches and switchboards; the St. Louis Car Heating Company, car heaters; A. O. Schoonmaker, mica specialties. The exhibit also included the Miller rail bond and a sample of the Niagara Habirshaw cable of 3,769,000 circular mils cross-section. The exhibit was in the charge of Mr. Joseph Franklin, Jr., president of the company, assisted by Mr. V. Raggio, Mr. James O'Brien, and Mr. Paul D. Cable.

THE STEEL MOTOR COMPANY was represented by Mr. Geo. W. Henry general sales agent, Chicago, and Mr. Eugene C. Parham, electrician at the Johnstown, Pa., works. The exhibit attracted considerable attention. Mounted on a Dupont truck, now winning much favor as a symbol of simplicity and durability, were two C No. 3½ steel motors operated by two C No. 3 controllers. The C 3½ motors are the latest tested and time tried production of the Steel Motor Company. The motor is constructed upon substantial lines, is noted for its staying powers and durability, and enjoys the distinction of offering easy access to any part without disturbing any other. The C No. 3 controller is of the series-parallel type and has the usual locking and interlocking devices, but has the unique feature that the motor cut-outs are incorporated within the control of the reverse lever, thus making it unnecessary to open the controller to cut-out a motor. This innovation seems to have been indorsed by technical admirers and by the many practical motormen who availed themselves of the opportunity to witness and also try its operation.

THE J. G. BRILL COMPANY, Philadelphia, Pa., had a most extensive car exhibit at the Auditorium. Among the equipments shown were an electrically operated street sweeper, equipped with Westinghouse motors, a handsomely fitted street car, together with the latest types of Brill trucks. Mr. John A. Brill has perhaps done more toward making a permanent success of the American Street Railway Association than any other member. The J. G. Brill Company has always been one of the most liberal in incurring expense to bring the latest types of its manufacture to the convention for the benefit of those present at the meetings. Mr. Brill also attends in person, accompanied by a large staff of his most experienced men, with a view to explaining the company's equipments to those who may desire information. It is reported that the expenses of the Brill Company at the St. Louis Convention were $10,000, which will enable the reader to appreciate the extent of Mr. Brill's contribution to the success of the St. Louis meeting. Messrs. W. H. Heulings, Jr., Samuel M. Curwen, M. Hodgeman, F. C. Randall, W. Patterson and C. R. Frederick, of the Brill Company, were justly proud of their handsome display.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY'S exhibit was found in a very central location, in fact in the middle of the hall, where this well-known company had a display of motors, switchboard apparatus and sundry literature describing the same. Among the motors the No. 12 A and 38 B, mounted on Peckham trucks and on a Brill snow sweeper, attracted the general attention of such of the delegates as were not familiar with their construction and mechanical design. The particular novelty, however, of the Westinghouse exhibit, and from an electrical point of view the most interesting part, was the display of switches and circuit breakers. These appliances are of recent design and embody some very novel features of improvement, which strongly appealed to practical men. The chief characteristics of the switches are their enormous carrying capacity and ease of operation as compared with the older types. The company manufactures these appliances up to 3000 ampere capacity. The circuit breakers are of equally easy operation. They have copper carbon shunts, preventing all possibility of burning at main contact points, and are provided with a releasing device without the use of the solenoid. Means of adjustment are sliding weights over scale arm. These instruments were shown on a two-panel switchboard, one being a 2000-ampere generator panel and the other a 1200 feeder panel. In addition to these instruments the exhibit also contained samples of the well-known Wurts non-arcing lightning arresters, tank arresters, as well as a pyramidal arrester for high potential transmission circuits. The company was represented by the following strong array: Messrs. G. H. Lewars, Albert Schmid, W. F. Zimmerman, C. E. Bragg, A. J. Wurts, H. P. Davis, A. Hartwell, J. A. Rutherford, C. E. Skinner, T. A. Cleland, H. C. Ebert, M. Coster, W. R. Brown, A. F. Gordon, N. W. Storer and E. H. Heinrichs.

THE GENERAL ELECTRIC COMPANY made from an electrical standpoint perhaps the most comprehensive exhibit of apparatus in the auditorium. It included almost every device used on electric railways with the exception of generators. The most prominent feature of the exhibit was one of the motor trucks which is to be operated on the Brooklyn Bridge structure at New York. This truck is of McGuire manufacture, and carries two G. E.-50 motors, a special motor designed to meet the peculiar conditions of the bridge service. One of the controllers used to operate this bridge car equipment was also shown. To the right of this compact equipment was a Peckham truck with complete electrical equipment of two G. E. 1000 motors and electric brakes, controlled by a B-3 series parallel controller, shown in operation. Many favorable comments were made on the positive action of this brake, and the startling suddenness with which the motion of the wheels was brought to a stop. Directly opposite this equipment on the other side of the space was a Diamond trailer car truck, fitted with an electric brake for use with trailer cars. The centre of the space was occupied by one of the Nantasket Beach air compressor equipments, motor, pump, tank and automatic switch. To this was fitted one of the chime whistles used on that important innovation in steam railway practice. This equipment was described in the last issue of THE ELECTRICAL WORLD. A handsome switchboard of the well-known panel type, made up of generator and feeder panels, with full equipment of standard instruments, was set up at the rear of the space. One of the panels was of the station type, carrying a type G recording wattmeter measuring and recording the total watt output of the station. In the motor department were shown G. E. 800, 1000, 1200 and 2000 type motors. An unfinished G. E. 800 armature was also exhibited. Two four-faced pyramid stands carried samples of the switches, cut-outs and nickel-plated overhead line supplies, while on a table were shown the latest styles of frogs, turnbuckles, strain insulators and other improved devices of the G. E. overhead railway equipment. Two styles of trolley, the United States standard, and the other known as the United States S. trolley, for low-bridge work, were shown, and the method of shipping commutators for motor armatures was exemplified by three full sets of commutator segments, bound solid for shipment from the works. The work of the General Electric Company in the steam railway field was exemplified by a large photograph of the 96-ton locomotive coupled with a Royal Blue express train. A length of the third rail over which regular trains are now being operated between East Weymouth and Nantasket Junction, on the main line of the Old Colony Division of the N. Y., N. H. & H. R. R., served to illustrate another electrical system for high-speed service. The magnetic blow-out principle applied to G. E. controllers, circuit breakers, lightning arresters, etc., was explained by two arc-making devices exactly similar in construction so far as the breaking mechanisms went. One only was fitted with the blow-out device. Movement of a handle broke the circuit in each alternately. In that fitted with the blow-out the arc was immediately extinguished; from the other the bright green flame of burning copper was startling in its volume and intensity. The object lesson was not overlooked by the delegates. The space was handsomely illuminated by a large script sign, and by the famous G. E. monogram in vari-colored miniature incandescent lamps. Around the space and under the gallery were a series of 10 Thompson arc lamps for use on railway circuits. The new apparatus shown outside of the brake, comprised the M. automatic circuit-breaker for car and other work, a modified form of the K. automatic circuit-breaker for station and work of that character, railway and arc lightning arresters and other minor devices. The headquarters of the company were located in the main parlor of the Southern Hotel. This parlor was courteously tendered to the association by the company for the reception on Tuesday evening. The parlor was handsomely decorated with ferns, and a contingent of the company was always present to receive the visiting delegates. One of the features of the convention was the informal reception held by the ladies every evening in the smaller parlor of the headquarters. The interests of the company were taken care of by Messrs. William J. Clark, B. E. Sunny, F. M. Kimball, T. Beran, Ralph Beach, C. C. Pierce, H. J. Crowley, F. H. Striely, F. M. Boyer, Theo. P. Bayley, G. K. Wheeler, H. C. Wirt, L. H. Parker, E. M. Hulett, George D. Rosenthal, W. B. Potter and John McGhie.

Among those present not mentioned in the foregoing notes were:

J. B. Allen, the Edward P. Allis Company, Milwaukee, Wis.
Willis M. Anthony, New Haven Car Register Company, New Haven, Conn.
Thomas Ashburner, Babcock & Wilcox Company, New York.
Edward Beadle, New York.
Robert J. Bellamy, Vestlette Manufacturing Company.
William T. Bonner, the Babcock & Wilcox Company, New York.
A. H. Bouslog, Peru Electric Manufacturing Company, Peru, Ind.
E. S Bowers, Bowers Bros., Chicago.
F. B. Brownell, Brownell Car Company, St. Louis.
W. C. Brownell, Brooklyn & New York Railway Supply Company, Elizabethport, N. J.
J. Vernon Campbell, Campbell & Zell Company, Baltimore.
E. F. Carry, Jr., the Wells & French Company, Chicago.
Frank R. Case, Hoopes & Townsend, Philadelphia.
Charles A. Cavagna, R. D. Nuttall Company, Allegheny, Pa.
Will Christy, Cleveland Construction Company, Akron, O.
J. W. Cleary, Neal Electric Headlight Company, Boston.
G. Fred Collins, Valentine & Co., New York.
Frank E. Colbert, Terre Haute Car & Mfg. Company, Terre Haute, Ind.
S. B. Condit, Jr., L. A. Chase Company, Boston.
J. O. Crane, Holmes, Booth & Haydens, Waterbury, Conn.
E. A. Curtis, Chicago Truck Company, Chicago.
George E. Daggett, Weber Railway Joint Mfg. Company, New York.
D. B. Dean, Terre Haute Car Manufacturing Company, Terre Haute, Ind.
Thomas H. Dickinson, New York Belting & Packing Company, New York.
E. D. Draffen, Safety Insulated Wire & Cable Company, New York.
A. H. Englund, Mayer & Englund, Philadelphia.

William Fay, The C. & C. Electric Company, New York.
Walter L. Flower, Acme Filter Company, St. Louis, Mo.
Pierre A. Garneau, National Conduit Manufacturing Company, New York.
W. R. Garton, Garton-Daniels Electric Company, Keokuk, Ia.
J. F. Gerleman, International Electric Company, St. Louis, Mo.
H. M. Grier, Clarence Whitman & Company, New York.
Thomas J. Grier, Western Electric Company, Chicago, Ill.
S. F. Hammond, Pennsylvania Railway Supply Company, Philadelphia, Pa.
George H. Helvey, Hooven, Owens & Rentschler Company, Hamilton. O.
H. M. Daggett Jr., Lombard Hydraulic Brake Company, Boston, Mass.
W. H. Hooper, Safety Car Heating & Lighting Company, New York.
Albert Hoppin, The Edward P. Allis Company, Milwaukee, Wis.
J. C. Hooven, Hooven, Owens & Rentschler Company, Hamilton, O.
Clarence H. Howard, Scarritt Furniture Company, St. Louis, Mo.
O. M. Hubbard, Bradford Belting Company, Cincinnati, O.
H. E. Hunt, Hunt Air Brake Company, Pittsburg, Pa.
A. H. Hutchinson, Frick Company, Waynesboro, Pa.
William H. Ives, Ives & McClerman, Baltimore, Md.
C. D. James, The Standard Paint Company, New York.
Harry Johnston, Charles Scott Spring Company, Philadelphia, Pa.
M. A. Knapp, Graphite Rheostat Company, Chicago, Ill.
George Kissam, George Kissam & Co., New York.
C. K. Kuchubreker, Griffin Wheel Company, Chicago, Ill.
G. C. Kuhlman, G. C. Kuhlman Company, Cleveland, O.
F. D. Lawrence, Standard Electrical Works, Cincinnati, O.
P. Leidenger, Dayton Manufacturing Company, Dayton, O.
Jos. Leidmayer, Dayton Manufacturing Company, Dayton, O.
Alex. H. Lewis, Aultman & Taylor Machinery Company, Mansfield, O.
S. W. Lombard, Lombard Hydraulic Brake Company, Boston, Mass.
Herbert Lloyd, Electric Storage Battery Company, Philadelphia, Pa.
H. P. Lucas, Graphite Rheostat Company, Chicago, Ill.
T. P. Luther, American Electrical Heating Corporation, Boston, Mass.
Robt. B. Lyle, Illinois Steel Company, Chicago, Ill.
F. B. Many and John A. Mehling, Mehling Mfg. Company, Cleveland, O.
W. B. Mays, Hooven, Owens & Rentschler Co., Hamilton, O.
Joseph Major, St. Louis Mica Company, St. Louis.
Frank McCoy, Brooklyn, N. Y.
Frank McGovern, Rossiter, MacGovern & Co., New York.
M. McNeill, Jr., Central Electric Company, Chicago, Ill.
J. G. Miller, Pittsburg. Pa.
Seirjo Mine, Elec. Engr. for the Japanese Government, Tokio, Japan.
L. E. Myers, Electrical Installation Company, Chicago, Ill.
Garson Myers, Standard Railway Supply Company, Chicago, Ill.
A. F. Newbert, Decatur Car Wheel & Mfg. Company, Decatur, Ind.
S. P. Nichols, J. H. McEwen Manufacturing Company, Ridgeway, Pa.
Edwin H. Oswald, Benedict & Burnham Manufacturing Company, New York.
H. L. Page, Phœnix Carbon Manufacturing Company, St. Louis, Mo.
Charles M. Parker, Charles Scott Spring Company, Philadelphia.
H. L. Parker, Emerson Electric Manufacturing Company, St. Louis, Mo.
J. N. Parsons, A. Mertes Manufacturing Company, Allegheny, Pa.
George J. Percival, Electric Storage Battery Company, Philadelphia, Pa.
G. E. Pratt, Hunt Air Brake Company, Pittsburg, Pa.
Mason D. Pratt, The Pennsylvania Steel Company, Philadelphia, Pa.
E. Prouty, Devlin Street Car Brake Company, Chicago, Ill.
M. B. Post, The Billings & Spencer Company, Hartford, Conn.
D. W. Pugh, John Stephenson Company, New York.
William C. Pullman, Bushnell Manufacturing Company, Easton, Pa.
G. H. Quinn, Detroit Steel & Spring Company, Detroit, Mich.
R. J. Redick, Standard Paint Company, New York.
A. T. Reynolds, Taylor Electric Truck Company, Troy, N. Y.
E. I. Robinson, Laclede Car Company, St. Louis, Mo.
J. H. Rhotehamel, Columbia Incandescent Lamp Company, St. Louis, Mo.
Charles D. Shain, Weston Electrical Instrument Company, New York.
J. C. Shainwald, Standard Paint Company, New York.
Charles E. Sharp, Southern Electrical Supply Company, St. Louis, Mo.
J. H. Siegrist, Jr., A. L. Ide & Sons, Springfield, Ill.
H. E. Skinner, Chas. Munson Belting Company, Chicago, Ill.
E. J. Spencer, Safety Insulated Wire & Cable Company, New York.
Luther Stieringer, New York.
M. A. Sullivan, Charles A. Schieren & Co., New York.
J. J. Sullivan, Hamilton Corliss Engines, Hamilton, O.
J. A. Vail, Hoover, Owens & Rentschler Company, New York.
A. C. Vosburgh, New Process Rawhide Company, Syracuse, N. Y.
James P. Wattles, Rand Avery Supply Company, Chicago, Ill.
W. H. Wilkinson, Diamond Truck & Gear Company Kingston, N. Y.
John R. Williams, Electric Storage Battery Company, Philadelphia, Pa.

Convention Notes.

THE OKONITE COMPANY had no special exhibit, but Captain Candee was there, and the captain is a host in himself.

THE INTERIOR CONDUIT & INSULATION COMPANY, of New York, had a parlor at the Southern, and Mr. E. B. Kittle did the honors.

THE NATIONAL UNDERGROUND CABLE COMPANY, of New York, was represented by Mr. J. P. McQuaide with some very handsome samples.

THE AMERICAN ELECTRICAL WORKS, of Providence, R. I., were represented by Mr. P. C. Ackerman, the New York agent, and Frank E. Donohue, manager of the Chicago office.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, Cincinnati, O., was represented by Mr. E. P. Morris, its New York agent, and Mr. W. R. Mason, of the Mason Electric Electric Equipment Company, its Chicago agent.

MR. HARRY SCULLIN was ubiquitious all through the Convention, and made so many friends that the compliment of his election as a member of the Executive Committee was but a small testimonial to the regard in which he was held.

THE CENTRAL ELECTRIC COMPANY of Chicago had its exhibit in connection with that of the Southern Electrical Supply Company, its St. Louis agent, and was represented by Messrs. C. B. White, O. Glenn, Jr., E. S. Buchanan and C. W. Cobb.

MR. ARTHUR S. PARTRIDGE, of the Reception Committee, exerted himself without stint in extending the courtesies of St. Louis to those in attendance at the Convention, and many will long remember with pleasure the heartiness and spontaneity of his welcome.

MR. C. NESBITT DUFFY, who has charge of the seating arrangements at the banquet, succeeded in placing everybody so satisfactorily that the success of the dinner was assured from the start, and the bright and satisfied faces of the guests were an inspiration to the speakers.

MR. E. H. ABADIE, manager of the Wagner Electric Company, showed himself most thoughtful of the comfort and enjoyment of those who visited St. Louis to attend the Convention. Although a very busy man, Mr. Abadie managed to spare considerable time during the Convention to devote to the entertainment of the delegates.

MR. G. D. ROSENTHAL, the representative of the General Electric Company in St. Louis, worked indefatigably during the Convention as a member of the Reception Committee. Mrs. Rosenthal was the bride of the Convention, and was as successful in winning golden opinions from the visiting ladies as Mr. Rosenthal was popular with the gentlemen.

MR. JOSEPH FRANKLIN, JR., president of the Commercial Electrical Supply Company, was one of the most energetic members ot the local Entertainment Committee. Early and late he was about, intent upon every one's comfort but his own. The visitors will long remember his genial smile and cheery presence. Mr. Franklin is one of the wealthiest men of his age in St. Louis, but no one would suspect this from his unassuming manner and bearing. He is said to be engaged to a most charming young lady, who is certainly possessed of admirable taste.

MR. J. H. STEDMAN as toast-master at the banquet was the right man in the right place. Those who know Mr. Stedman do not need to be told of the sparkle he lends to an occasion of this kind. One example of his ready wit may be mentioned. Lawyer Galt in his address commended the idea of attaching numbers to the badges of the delegates. He said that when a street railway man was picked up on the curbstone after contact with a live wire or the like, the number would identify him so that he could be promptly returned to his hotel. Mr. Stedman, who may in his day have had experience in litigation, explained to Mr. Galt that the intention of the numbers was that in case a street railway man got into a lawyer's office his number at least would be left.

Air-Motor Cars on the Lenox Avenue Line.

On Oct. 20 several officers of the Metropolitan Traction Company made trips over the Lenox Avenue branch of that company's system on an air-motor car, and from all reports it is inferred that they were highly pleased with the results. It is stated that this car has been in operation on this line for three weeks past, but it has failed to attract attention for the reason that it is exactly like the trolley cars now used, as regards outward appearances. The motors were manufactured by the American Wheelock Engine Company, Worcester, Mass., where considerable experimentation was carried on prior to the test now being made on the Lenox Avenue line. It is stated that the car has been carrying passengers regularly and has not missed a single trip, and nobody outside of the employees and the officers of the company knew that it was not a standard trolley car. The air-compressing equipment is installed at the 146th Street power-house of the Traction Company, and at this point the car receives its supply of air, which is stored in tanks carried underneath the floor. The air motors, to the casual observer, cannot be distinguished from the ordinary electric motors, and are attached to the forward and rear axles of the car. On the front and rear platforms are levers similar to those of the controllers on an electric car, which are used for the purpose of controlling the air engines. A second car, equipped in a similar manner, has reached the shops, and a third one is expected about this time. These, it is stated, are to be followed by ten more, which will be put into service on the Lenox Avenue line as fast as they arrive.

Chief Engineer Fred S. Pearson, of the Traction Company, sailed for Europe on Oct. 21, for the purpose of examining the compressed air systems in use abroad. With this object in view he will visit Paris, Berlin and Dresden, and on his return he will institute any necessary modifications in the system here as may seem to him advisable after making an examination of the foreign systems.

A director of the company is reported to have said that the Eighth, Seventh, Sixth and Fourth Avenue lines will shortly be equipped with air motor cars, and that ultimately this system of propulsion will be introduced on the Twenty-third and Thirty-fourth Street crosstown lines.

In this connection an interesting story was published in the New York *Herald* of Oct. 23, to the effect that there exists a serious difference of opinion among the directors of the Metropolitan Traction Company regarding the relative merits of compressed air and electricity as a motive power. It is stated that Messrs. William C. Whitney and John D. Crimmins, who wield an influence in the board, though they are not themselves directors, are the champions of the rival systems, Mr. Whitney favoring the compressed air and Mr. Crimmins electricity. It is stated that Mr. Whitney has been deeply impressed and interested in the experimental trips of the air motor on Lenox Avenue and believes that the motor has proved a success. The faction represented by Mr. Whitney, it is stated, is determined to have the air system installed on all the company's lines. Mr. Crimmins, on the other hand, it is reported, favors the underground trolley system which has been in operation on that line for over a year, and was largely instrumental in its introduction. He is credited with the statement that the system is a success. It is further stated that Mr. Paget, a director of the company and a son-in-law of Mr. Whitney, and who is also interested in the concern which manufactures the air motors in question, represents the air faction, which party has virtual control of the situation at the present time.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

BY CARL HERING

DYNAMOS, MOTORS AND TRANSFORMERS.

Armature Reaction. ZIEHL. *Elec. Zeit.*, Oct. 8.—A communication discussing the recent article of Rothert (see *Digest*, Oct. 8). He thinks some of the statements are not warranted ; Rothert assumes that the armature reaction in three-phase machines is due to a constant revolving field, but this the present writer believes is limited only to the special case of a two-pole machine, and that its application to multipolar machines is not warranted ; he discusses two extreme cases and gives a formula for the two resulting numbers of ampere-turns for the average machine lying between these two extremes ; he shows that the demagnetizing action of the armature coils on the magnetic field is not a constant but is slightly oscillating, and it can be taken as a constant only when it is equal to about the arithmetical mean of the expression which he gives ; the same result is obtained for three-phase motors. Another point to which he objects is that there is no proof given that the whole ampere-winding contributes to the armature reaction or demagnetization ; it is in fact not the case, as was shown by Kapp ; if there is no phase-shifting in the external circuit, and if the secondary magnetic leakage is negligibly small, it can happen that there is no armature reaction. In a second communication on this same paper by HAAS, it is stated that one of the fundamental assumptions is not warranted ; Rothert assumes that the magnetic resistances of the primary circuit is equal to that of a magnetic circuit in any other direction, but this is not the case in the usual type of machines, and it is therefore not correct to combine the magnetic forces directly without taking into consideration the changes in the magnetic resistance of the circuit.

LIGHTS AND LIGHTING.

Jandus Lamp. Lond. *Elec. Rev.*, Oct. 9.—A reply by the makers to the recent published tests (see *Digest*, last week). They claim that the best proof of the satisfactory character of the lamp is that it is replacing the older form of lamp very rapidly; they believe that the mean spherical candle-power is the same if not greater with this lamp and that the light is whiter; it is quite evident from those tests that the lamps were not worked at the proper voltage and that there was an admission of air. They state that they have succeeded in making an experimental alternating lamp for 75 volts and 6 amperes, in which the arc is also enclosed.

Tests of Incandescent Lamps. SATCHWELL. Lond. *Elec. Rev.*, Oct. 9.—Referring to the recent tests of Preece (see *Digest*, Oct. 17 and 24), he states that as the lamps used were manufactured in 1894, the tests are no criterion of those produced to-day; some makers have completely changed their methods of manufacture within the last two years. Editorially it is believed that the general behavior of the average lamp has not altered and that the tests are most certainly valuable.

Influence of the Carbon in an Arc. MARKS. *Elec. Eng.*, Oct. 14.—A note pointing out the influence of the composition of the carbon on the spectrum of reflection; referring to Birchmore's article (see *Digest*, Oct. 10), he states that Meyer's figures on the relative composition of the different lights are apt to be misleading; the quality of the light as distinguished from its candle-power must be carefully considered in the selection of the carbon; a solid carbon will give entirely different results from one that is cored, the material of the core having a marked effect; the composition of the light also depends on the current and the voltage.

POWER AND HEAT.

Combined Gas Engine and Dynamo. Lond. *Elec. Rev.*, Oct. 9.—A brief, illustrated description of a new departure in the form of a direct-driven dynamo; the one shown has a speed of 160 revolutions and a capacity of 164 brake horse-power, the dynamo yielding 100 volts and 750 amperes; it is intended for electrolytic operation (it is not stated whether the speed is sufficiently constant to enable it to be used for lighting).

Electrically Driven Ladder Dredger. Lond. *Engineering*, Oct. 9.—An illustrated description of a form devised by Varilla to be used in dredging the River Esla; it is electrically driven throughout, by seven three-phase motors; the chain of buckets is driven by a 45 hp-motor; the average demand is about 15 horse-power; the primary current has a voltage of 2000, which is transformed down to 200.

Electrically Driven Ventilating Fan. Lond. *Engineering*, Oct. 9.—An illustrated description of a direct-coupled motor-fan used in some new office buildings; the speed is only 375 revolutions; the current is 8 amperes at 105 volts, and it is said to deliver nearly 200,000 cubic feet of air per minute.

Electric Cranes. ANDERSON. Lond. *Elec. Rev.*, Oct. 9.—A reprint of his B. A. paper which was noticed in the *Digest*, Oct. 17.

Thermo-Electric Battery. ASHER. *Canadian Elec. News*, October.—Several suggestions for improved forms with a view to securing better economy. In one of these he uses the regenerative principle; in another, an artificial draught which he claims can be maintained more economically than a natural one; to reduce the initial temperature he forces air into the hot gases, thus giving a greater volume at a lower temperature; he states that there is no advantage in maintaining the heated ends at a temperature more than 90 degrees higher than the cooler ones, and he therefore has several sets, using the cooler ends of the first set as a source of heat for the hotter ends of a second set and so on; applying the second law of thermo-dynamics and using limiting temperatures of 960 degrees Fahr. and 150 degrees Fahr., he calculates an efficiency of 57 per cent.

Graphite from the Electric Furnace. ACHESON process. *Elec. Eng.*, Oct. 14.—A brief description of the method used at the carborundum factory at Niagara Falls. He found that there is no direct conversion of carbon into graphite in the electric furnace, and that the yield of graphite produced by highly heating pure carbon is insignificant; the conversion is an indirect one, it being a dissociation of the carbon from its combination with other materials, and that there is a preliminary step in chemically combining it with some other material; he thus found that a considerable portion of mineral matter must be mixed with the carbon, as this will enormously increase the yield of graphite. The material is packed in the furnace through which a carbon rod passes; it is composed of a mixture of powdered coke, sand, salt and sawdust, the coke forming about 50 per cent. of the weight of the mixture; the heat is generated in the carbon rod; corborundum is formed first and after increasing the temperature the graphite is formed from it, the silicon being volatilized; the carbonized material should contain as little volatile matter as is practicable. With this furnace having a core seven feet long by four inches wide, composed of granular coke or carbon, the starting current is about 50 amperes at 650 volts, which is afterward changed to 1000 amperes at 100 volts.

Electric Iron Smelting. LAVAL process. *Elec. Eng.*, Oct. 14.—A brief note from the *Iron Age* on this process, which is to be operated in Sweden for the reduction of iron ore to metallic iron by means of an electric arc ; it is proposed to either manufacture steel direct, or a cast product which can afterwards be utilized in the Siemens-Martin furnace ; the process is said to consist in mixing pulverized ore with carbon and subjecting it in a rotating cylinder to heat, after which it is brought into direct contact with an electric arc of great power, reducing the ore to metallic iron, which flows into another furnace, in which it is converted into steel or cast in suitable forms for further treatment. No further description is given.

Big Creek Power Transmission. *Elec. Eng.*, Oct. 21.—A brief description of this plant near San Francisco ; the waterfall has a power of 500 horse-power and a height of nearly 1000 feet ; the two-phase generator operating at 1100 volts is connected with transformers to raise the current to a voltage of 10,000 to 11,000 and at the same time transfer the two-phase current into a three-phase current by the Scott system ; the plant is about to be duplicated.

TRACTION.

Liverpool Overhead Railway. COTTRELL. Lond. *Elec.*, Oct. 9.—A long abstract of a B. A. paper in which he gives a detailed description of this road, including that of the recent southern extension, consisting partly of a viaduct and a tunnel; operating data is given, including a load diagram of the generating station, some of the curves for the motors and the records of a trip; a comparison is also made with operating data of the City & South London underground railway. During the first half of this year the energy generated for running the cars was at the rate of 4.29 kw-hours per train mile, the full trains weighing 38 tons; in the average load only 60 per cent. of the seating accommodation was occupied, representing only about 35.5 tons; the energy developed therefore, exclusive of that used for signals, has been at the rate of 0.121 per train mile. Roller bearings are to be fitted to the rolling stock, and it is thought that a three-car train will then require no greater maximum starting effort than two-car trains under the present conditions; editorially this is questioned, as the acceleration consumes such a large portion of the starting effort.

Electricity for Steam Railways in France. DE MARCHENA. Lond. *Elec. Eng.*, Oct. 9; abstracted briefly from the Bulletin of the French Society of Civil Engineers.—The original is practically a treatise on electric railways; he reviews what has been done, especially in America, and concludes that in the existing state of the industry the conversion of the

French steam railway lines into electric lines would be perfectly possible, and that the expense of the work would be small in comparison with the amount of capital already sunk in the lines; he estimates the cost at about $10,000 a mile and believes the increased receipts and reduction of working expenses would more than cover the cost of interest and the sinking fund; he considers it feasible to use a much higher voltage, say 1000 or 1200.

Traction Diagrams. Tomlinson. Lond. *Elec. Rev.*, Oct. 9.—A continuation of his long serial (see *Digest*, Sept. 12). He discusses diagrams plotted on a time basis and shows how the power required for acceleration, for overcoming friction and grade, may be determined; as long as the grade remains the same and track straight, the simple rule for getting the average power per ton is as follows: Multiply the mean drawbar pull necessary for acceleration (in pounds) by the mean between the initial and terminal speeds (in feet per seconds), and multiply the drawbar pull due to friction and grade (in pounds) by the mean speed of the run (in feet per second), add together and divide by 550; the result is the mean brake horse-power; traction diagrams plotted on a time basis give all the information that could be desired, but they can never be made self-recording. He applies the method to the load diagram of the Baltimore & Ohio electric locomotive, showing a close agreement between theory and practice.

Underground Railway in London. Lond. *Elec. Eng.*, Oct. 9.—A brief statement that a syndicate has been formed for an electric railway from the City to Earl's Court in a tunnel below the existing underground steam railway, the object being to use it for express service.

Railway in Fairmount Park, Philadelphia. Elec. Eng., Oct. 21.—A brief, illustrated description of this new line under construction, and intended for pleasure purposes. The line is about seven miles long, winding through the park; all grade crossings are avoided by means of 20 bridges; at present there are 30 motor cars and 30 trailers, having eight wheels each and a seating capacity of 72 persons; the motor cars are equipped with four G. E.-1000 motors, also with electric brakes; there is no ascending grade greater than 4 per cent.; the whole construction is made as little unsightly as possible, and is all of a specially heavy character; 90-pound T-rails are used, and are bonded with the plastic bond; there is a large return feeder, which it is stated gives the smallest drop on the ground circuit obtained in any other road constructed up to the present time; the maximum drop in the entire system is 10 per cent.; the cables are drawn into subways of treated wood; the station is equipped with three tandem-compound engines directly connected to 500-kw generators.

Street Railways in St. Louis. St. Ry. Jour., October.—A very long, profusely illustrated article on the city, its growth and its street railway systems, including a number of diagrams showing the distribution of the population and the street railway systems, also a colored map showing the various railway systems. The article includes one by McCulloch on the street railway cars in St. Louis; another by Bartlett on the power-stations, giving brief descriptions, accompanied by ground plans.

St. Louis Power Stations. Elec. Eng., Oct. 21.—Brief descriptions, with illustrations, of several of the stations.

Street Railway Properties of America. St. Ry. Jour., October.—A tabulated list of 29 surface and elevated railway systems in the United States whose gross earnings amount to $1,000,000 or more, giving the principal financial characteristics of each, accompanied by a brief discussion, in which the elements of strength and weakness in each property are pointed out.

Jungfrau Electric Railway. Spokes. *Elec. Eng.*, Oct. 14.—A brief note from an English paper stating that 150 men are now at work on this line and expect to finish this autumn the roadway construction to the Eiger; a brief description of part of the route is given; there will be a branch line to the Rhone valley; the cost, it is thought, will not exceed $2,000,000; it is expected to finish the railway in six years; a train will be run every eight minutes.

Street Railway Cars in the United States. St. Ry. Jour., October.—An illustrated description of a large number of typical cars, chiefly for electric railroads.

Conduit Railway for Chicago. Elec. Eng., Oct. 21.—A note stating that a line using a conduit system is to be constructed in Chicago.

The Street Railway Track of the Future. Eng. News, Oct. 15.—An editorial article questioning whether the system of wooden cross ties at present universally used is the best, and suggesting the possibility of a system consisting of a longitudinal system of rail support as being more economical and durable, reducing the cost and difficulty of track repairs; the necessity of burying such a large amount of perishable wood beneath the pavement is questioned; it is suggested to lay under each rail a solid foundation of a sufficient width and either lay the rail directly on it or else on a light stringer of wood resting on this foundation; the first cost of such a system would perhaps be a little greater, but it is probable that the reduced cost of track maintenance would much more than offset this.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

System of Charging for Electric Energy. Hordern. Lond. *Lightning*, Oct. 8.—In a long article he discusses the well-known Wright system, showing that at first thought it is a good one, but after looking carefully into it he concluded that it could not be applied to his (Westminster) station, as it would be wrong to do so; he then explains what he considers to be a more equitable system, which is adopted by his station, and is "to charge meter rent and to give a rebate to large consumers." In the Wright system there would be as much necessity to differentiate between the months of the year as between the hours of the day, and this would make the cost of the first set of units so heavy that people would probably not use the light at that time, with the result that the annual maximum load would occur on some other day and the object would be deviated; as an illustration he applies the same principle to railways, showing that it would lead to absurd results. In his own system he divides the cost of supply into "sleeping costs" and "working costs," the former including the various reserves and profit in companies, and the interest and sinking fund in corporations, that is, charges that have to be made over and above the actual cost of supplying, to provide for the capital invested; by working costs he means the cost of working the station, including management and machinery; he illustrates this at some length, giving figures and load curves. Among other things he shows that when a district is mixed in its character the maximum demand of each consumer is not a true measure of the amount of plant required to supply him.

Method of Charging for Electric Energy. Pink. Lond. *Lightning*, Oct. 1.—A brief description of the method adopted at Ayr. It is based on the assumption that a station may be remunerative irrespective of the day-load, motors, heating, etc., all of which should be classed as bi-products; also that any system of discounts requiring additional apparatus or placing any restriction on the consumers is unworthy of consideration; that the discount should be proportionate to the net profits contributed by the consumer; that meter rents are unfair charges; that every charge against revenue except coal may be considered as standing charge, and this charge, in addition to the cost of the coal, gives the total cost that must be earned before profits can be made. These standing charges at this station amount to 13 cents per kw-hour and the cost of coal is 1 cent; the price charged is 14 cents; he also assumes that the actual hours of demand for light do not amount to more than one hour a day. He gives a diagram showing the standing charges, coal and profit, earned by customers burning lights from one to five hours daily; discounts are given in proportion to the time the demand continues; for customers closing their stores at 7 p. m., for instance, there is no discount, at 8 p. m. 5 per cent. discount, and so on up to 11 p. m., at which the discount is 35 per cent.; (this appears to be applicable only for stores in which the closing time is well known); any extra time, cellar lights, etc., are entirely ignored.

Alternating-Current Switch Gear. Lond. *Elec. Rev.*, and *Elec. Eng.*, Oct. 9.—An illustrated description of a switch devised by Andrews, which is of the automatic non-return alternating type, and consists essentially of three parts, the first being an ordinary double break switch controlled by a handle, and is used only to make but not to break the circuit; the second part is a switch lever with contacts under water in an earthenware pot; the third is a compound wound relay; the switch and its application are fully described and illustrated; it is said to work very well; the field circuit of an alternator in parallel was opened, the steam was shut off, alternators were paralleled when the phases were not synchronous, and other things were done, all of which had no bad results owing to the quick action of the switch. More complete illustrations are given in the Lond. *Elec. Eng.*, Oct. 9.

Electric Light Fittings. Lond. *Elec. Rev.*, Oct. 9.—A communicated article pointing out the great want of improved fittings; electrical fitting manufacturers instead of being engineers are mere artists in metallic work and therefore make serious mistakes.

Central Stations in the British Kingdom. Lond. *Lightning*, Oct. 1.—Some tables giving a list of the stations, the date of starting and the system used.

Municipal Station at Jever. Elek. Zeit., Oct. 8.—A well illustrated description of a small installation, in which steam-driven, direct-current dynamos are used in connection with accumulators and a three-wire system.

Neuchatel. Elek. Anz., Oct. 1 and 4.—A German translation, with some of the illustrations of the descriptive article noticed in the *Digest*, Sept. 5; (see also Sept. 19).

Frankfort-on-the-Main. Elek. Zeit., Oct. 8.—Some tabulated data showing the variation of voltage at this station.

Congressional Library Building Lighting Plant. Hopkins. *Elec. Eng.*, Oct. 14.—A brief, illustrated description of this plant, which has a capacity of 6000 lights; a continuous current is used, with the addition of a number of 7.5 volt boosters; the large rotunda will be lighted with 2800 lamps of 32 candle-power; the book-handling system includes a miniature cable-way, operated electrically and delivering books at the centre of the rotunda.

WIRES, WIRING AND CONDUITS.

Concentric Cables. HETHERINGTON. Lond. *Elec. Rev.*, Oct. 9.—A reply to the criticism (see *Digest*, last week) of his recent article; among other things he does not admit that rubber is nearly as cheap, as it costs about two or three times as much.

ELECTRO-PHYSICS AND MAGNETISM.

Alternating Currents in Parallel Circuits. BEDELL. Lond. *Elec. Eng.*, Oct. 9.—A reprint of a B. A. paper of a mathematical nature on the division of an alternating current in parallel circuits with mutual induction. He takes the case of two identical coils wound on the same iron ring and connected in parallel, first so as to be additive and second so as to be opposed to each other; he gives the analytical and the graphical solution. The conclusions relating to the special case of two identical coils wound without magnetic leakage are as follows: When the coefficient of mutual induction is positive, the coils being wound in the same direction, the effect produced is the same as though the mutual induction were zero and the self-induction of each circuit doubled, the main current being the same that would flow in a single coil with the same self-induction and with half the resistance of either branch; when the coefficient of mutual induction is negative, the coils being opposed, each coil acts as though it were non-inductive, the magnitude of the current following Ohm's law and the angle of lag being zero.

Thermal Phenomena of Derived Circuits. CARDANI. *Nuovo Cimento*, August; noticed briefly in the Lond. *Elec.*, Oct. 9; a conclusion of his papers on the subject.—The development of the heat was observed by enclosing the wire in a tube filled with liquid, thus serving as a kind of thermometer. He found that metallic bands offer less resistance to oscillating discharges than cylindrical wires of the same cross-section; when the thickness in small as compared to the breadth, the thickness is without influence; the surrounding dielectric has no effect; ropes of wire in contact have nearly the same resistance as single wire of equivalent cross-section, but even when the wires are insulated the advantage is slight.

Heat Radiation from Wires. SALA. *Nuovo Cimento*, August; noticed briefly in the Lond. *Elec.*, Oct. 9.—He discusses the coefficient of external heat conductivity of vertical wires when they carry a current, which, together with resistance, the surface of the wire and the excess of temperature, are given; the vertical wires were 30 metres long and the temperature was determined by the expansion. He found that the coefficient varies with the diameter according to a law similar to that which applies to the case of horizontal wires investigated by Cardoni, but the loss of heat is greater with vertical wires and the wires themselves are therefore kept cooler; the loss is due chiefly to convection and not to radiation, as it was almost the same when the wires were blackened; but for vertical wires it depends largely on the mechanical condition of the surface, being greater when it is rough; the coefficient is independent of the temperature in vertical wires and Newton's law of cooling is strictly true.

Production of X-Rays. LANGER. *Electrochem. Zeit.*, October; abstracted briefly from *Naturwiss. Wochenschrift*, 31, p. 366.—He tried a number of substances to find their relative capacities for sending out X-rays (presumably when used as the reflector plate in the tube); their order is as follows: Phosphorescent sulphide of zinc, sulphide of calcium, tungstate of calcium, tungstate of barium, iodide of rhubidium, phosphate of uranium, tungstate of uranium and green oxide of uranium.

Effect of Röntgen Rays on Bacteria. *Electrochem. Zeit.*, October.—A note stating that a French physician, Despeignes, applied X-rays in endeavoring to treat an advanced case of cancer of the stomach; two applications of a half hour each were made daily, and after eight days there was a very appreciable improvement, the pain had diminished and the swelling was appreciably smaller; the treatment is to be continued.

Röntgen Rays. Lond. *Elec. Eng.*, Oct. 9.—In a recent address before the Pharmaceutical Society of Ireland, TICHBORNE urged that pharmacists should make the taking of Röntgen-ray photographs a part of their business.

Potential Difference Between Gases and Liquids. KENRICK. *Zeit. f. Phys. Chem.*, 19, p. 625; abstracted briefly in the Lond. *Elec. Rev.*, Oct. 9.—He proves the existence of a difference of potential at the surface of separation of gases and liquids.

Electric Currents Through Air. KELVIN, BOTTOMLY and MACLEAN. Lond. *Elec. & Elec. Eng.*, Oct. 9.—An abstract of the B. A. paper noticed in the *Digest*, Oct. 17.

X-Ray Apparatus. *Elec. Rev.*, Oct. 14, and *Elec. Eng.*, Oct. 21.—An illustrated description of the Thomson inductorium; the coil is in oil and the contact-breaker is a rotary one driven by a motor and breaking the current under water; another form is designed to operate from alternating-current circuits; the tube is of the double-focus type, having two cathodes of aluminum and an anode consisting of a wedge-shaped piece of platinum on which the rays are focused; the failing of the tube, owing to the increase of the vacuum, is provided against by an auxiliary tube containing a chemical mixture, which when heated gives off a vapor, bringing the vacuum down to the proper point.

Röntgen Rays at the B. A. Meeting. *Elec. Eng.*, Oct. 21.—A brief review of some of the papers, which have already been noticed in these columns.

ELECTRO-CHEMISTRY AND BATTERIES.

Applied Electrochemistry. SWINBURNE. Lond. *Elec.*, Oct. 9.—A reprint of his third Cantor lecture; the lectures are also being reprinted in full in the Lond. *Elec. Rev.* and *Elec. Eng.* He discusses the removing of tin from scrap, the metal aluminum, and the electrolysis of fused salt. Regarding the former he describes a process which consists in dipping the scrap into fused caustic, which works fairly well, but it is difficult to get the caustic to take up enough tin; he tried several processes, in one of which tin is taken off from one piece of iron and deposited from the solution on another piece, tin caustic bath being heated; the anode in this case does not give off oxygen and the process seemed perfectly successful, but the main difficulty was to get the scrap, as there does not seem to be any in the market. Regarding aluminum, he reviews its properties, explaining many of the actions of this metal by the existence of a coating of transparent alumina which immediately forms on the surface, owing to the very great affinity of this metal for oxygen; it is owing to this coating that soldering and plating becomes difficult; commercial aluminum also loses greatly by being impure, as it requires only very slight traces of impurities to spoil the metal; it is questionable whether the contamination by sodium can be avoided in the electrolytic processes; it would probably make a great difference in the value of the metal if it could be purified to say 99.9 per cent., and there is a great field for a cheap method for doing this. Among the other uses of this metal are those depending on its great affinity for oxygen, which enabled it to be applied in chemical and metallurgical operations; there are few metals which have so strong an affinity for oxygen, sulphur and chlorine. He questions whether the proposed methods of plating aluminum give really good results; it is quite easy, however, to coat copper or iron with a thick and permeable coating, which, however, is rough. Regarding the electrolysis of fused salt he enumerates the large number of difficulties encountered in the manufacture of sodium and chlorine from fused salt, which process seems at first sight to be so extremely simple; these difficulties are enormous; no metal can be used for the anode, but the cathode gives no trouble; he attempts to explain the cause of the small yield of sodium from fused salt; he favors Vautin's process, in which the cathode is fused lead with which the sodium alloys itself; this overcomes a great many of the difficulties, and the lead sodium alloy is available for many purposes for which plain sodium was employed; it can also be used for the production of cyanides from potassium ferro-cyanides.

Electrolysis of Milk. PHILIPP. *Electrochem. Zeit.*, October; a short article describing some experiments.—With two platinum electrodes the anode was covered with a white spongy material which floated to the top and consisted chiefly of caseine and fat and the milk was slightly alkaline after the operation; by continuing the process it was possible to withdraw practically all the solid material, leaving a translucent liquid, and there was no noticable deposit on the negative electrode; the action was quite local and the froth at the negative electrode caused by too rapid electrolysis was strongly alkaline. Another experiment made under the microscope showed a yellow precipitate on the anode; an acid was formed at the anode and an alkali at the cathode. By electrolysis the action which takes place in the milk when exposed to the air can be altered by separating a part of the whole of the caseine from the milk. He tried the Andreoli method of "indirect electrolysis," placing the milk in the middle portion of a vessel which was divided into three parts by metallic partitions, the two outside portions containing a solution of salt; a precipitate was formed in the middle portion on the side toward the anode; when all three compartments contained milk the deposit appeared on both of the walls of the middle compartment. Some experiments were made to preserve milk by extracting a part of its caseine electrically, but without success.

Plating Aluminum with Copper. *L'Elec.*, Oct. 10.—The difficulty in plating aluminum is due to the thin film of alumina which covers the metal and the problem lies in removing this film of oxide. The objects are first dipped in an alkaline carbonate for making the surface porous; after a thorough washing they are dipped in a warm solution of hydrochloric acid of about one part in twenty; they are then washed in pure water and placed for several seconds in a bath of sulphate of copper slightly acidulated, until a deposit is formed; they are then thoroughly washed and placed in the electroplating bath. The aluminum copper alloy containing 6 per cent. of copper can also be readily plated in this way, except that for the pickling solution warm dilute nitric acid should be used, and in this case they may be directly plated without first immersing them in the copper solution. The formation of the layer of alumina may be shown by using a copper cathode and an aluminum anode, in a sulphate of copper solution, when on starting the current it will be found that the resistance is so enormously increased that there is practically no current, even when the voltage is as high as 20; this is not a true phenomenon of polarization and shows that aluminum cannot be used to replace platinum in the Grove battery.

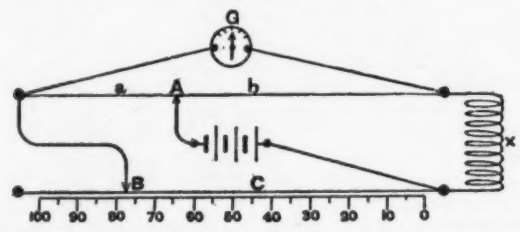
Electrolytic Preparation of a New Class of Oxidizing Substances. CONSTAM and VON HANSEN. *Zeit. f. Electrochemie*, Oct. 5.—They describe

the method of production and the properties of a number of these substances. They supposed at the start that when water is added gradually to solid carbonates of the alkalies, the dissociation of the salts will take place in steps, complete dissociation taking place only after a certain amount of dilution; if this assumption is correct it is to be expected that with great concentration and a high current density at the anode certain per-salts would be formed; in this article they describe the formation of some of these salts in this way; they started with the alkaline carbonate and converted them into per-carbonates, finding it necessary to operate at very low temperatures.

The Seat of the E. M. F. in a Cell. Lodge. Lond. *Elec.*, Oct. 9.—After referring to criticisms in general, he discusses unfavorably the recent statement by Swinburne (see *Digest*, Oct. 17) that there is no seat of the E. M. F. in a voltaic cell; he considers this a mistake which would not have been made if he had used a water or air circuit as an analogy; the present writer uses this analogy and shows that the seat of the water-motive-force is at the pump; he states that there is now no real controversy as it has been settled, the propelling E. M. F. existing wherever energy enters the electric circuit; the whole thing is clear at the present day.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Direct-Reading Wheatstone Bridge. Edgcumbe. Lond. *Elec.*, Oct. 9.—A brief, illustrated description of a method devised by him and specially adapted for measuring as rapidly as possible a number of resistances ranging from 0.1 to about 30 ohms, the only standard being a one-ohm coil. The arrangement is shown in the adjoining figure in which *a b* is



one slide wire and *B C* is another, the latter being provided with a scale; it therefore consists of a Wheatstone bridge in which only slide wires are used; the upper one provides merely for the ratio arms of the bridge and its length and resistance are immaterial; the unknown resistance is placed at *x* and its value is read off directly on the lower slide wire; the various points *A* are so determined as to give a convenient multiplier; this is done by replacing the unknown resistance with the standard one-ohm coil, placing the point *B* at some convenient mark, as 100, and then adjusting the other slider *A* so that there is no galvanometer deflection; this point will then be the proper one for a ratio of 1 to 100; by repeating this for other points along the scale the positions for the points *A* for various ratios is determined.

Hookham Alternating-Current Meter. Lond. *Elec. Rev.*, Oct. 9.—An illustrated description of the new form of meter, with a diagram of the connections and some curves of results; it is quite different from the one described some time ago, to which there was a number of objections, one of which was that it was not satisfactory on load circuits containing a high inductance; editorially it is stated that a reliable, cheap, shuntless, alternating-current meter, which will read accurately on inductive loads and has a good starting current, seems as far off as ever. The modifications in the present one are largely an elimination of some of the refinements in the previous form; it is compound-wound, having a series and a shunt coil.

A 10,000-Volt Testing Transformer. Lond. *Elec.*, Oct. 9.—An illustrated description of a Mordey transformer for cable testing and laboratory purposes, developing a moderately large amount of power and adapted to a 100-volt circuit; by various groupings of the secondary circuits from 200 to 10,000 volts can be obtained with a rated output of six kilowatts; it may also be used for Röntgen-ray experiments.

Reostene. Harker and Davidson. Lond. *Elec. Eng.*, Oct. 9.—An abstract of the paper noticed in the *Digest*, last week.

Checking Switchboard Instruments. Benecke. *El'ty*, Oct. 21.—A short article describing methods for checking station instruments while on the switchboard. With the voltmeters this is easily done by means of a reliable portable instrument; for obtaining lower readings than the normal voltage a number of lamps can be connected in series across the mains, and the station and standard voltmeters are then connected across one or more of the lamp terminals; to see whether masses of iron or current-carrying conductors have an effect on the reading, two readings should be taken in quick succession, turning the instrument for the second reading through an angle of 180 degrees, then if both agree there are no external influences, and if they differ the mean must be used. To check ammeters is more difficult; for alternating currents a dynamometer is the only reliable standard, and this must be placed directly in the circuit, but as there are seldom large currents this involves no difficulty; for direct-current circuits a standard millivoltmeter is used; the conductor in the circuit of the ammeter to be tested is provided permanently with two binding posts at a proper distance from each other, and the drop of potential between them is measured by the millivoltmeter; a formula is given for calculating the proper distance between these binding posts for a given millivoltmeter; when the station ammeter has external shunts the millivoltmeter may be connected directly to its terminals, and must then be adapted to that particular shunt; a correction for the temperature must also be made; the resistance of copper increases 1 per cent. for every 5 degrees Fahr., and the readings of the voltmeter must be corrected not only according to the temperature of the instrument with the instrument coefficient, but also according to the temperature of the shunt with the shunt coefficient, unless this is zero, as with Weston shunts; the precaution to eliminate the influence of external fields mentioned above must also be taken; to check the ammeter over a wide range without varying the main current, in the case of shunted ammeters, connect a German silver wire across the terminals of several gravity cells and apply the terminals of both the ammeter and the millivoltmeter to this wire, moving them over it, thus using it as a potential wire; a resistance may be inserted with either of the instruments to make them read alike; such a test will show whether the proportionality of the scale is correct.

New Method of Reading Galvanometer Deflections. Rice. *El'ty*, Oct. 21.—A reprint of the article abstracted in the *Digest*, Oct. 17.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Submarine Cables. Lond. *Elec.*, Oct. 2.—An editorial note on Preece's paper (see The Electrical World, Oct. 17). There are three ways of decreasing or retarding the effect of the capacity of a cable, the first is to increase the mutual induction between the two conductors, the second is to decrease the capacity itself, and the third to decrease the insulation resistance; the applicability of the third method seems to have been ignored; it is well known that a uniformly distributed low insulation tends to increase the speed of working. After referring to the method used in France of blowing dry air through a lead-covered paper cable, it is suggested that a method of manufacturing cables may be founded on these lines; the two copper wires for the telephone circuit could be paper-covered and then laid parallel, but not cabled; a few loose braidings of cotton or jute might be put on to reduce the capacity between the conductors and the earth, the whole being then lead-covered; a current of air passed through the tube would enable the insulation resistance to be brought to some fixed low value. Such a cable would possess to a much greater extent than any existing gutta-percha-covered cables the three properties required for high speed working; the questions arise whether the lead covering would resist the action of the sea water and whether the deep sea portions would withstand the pressure; it is thought that the laying of a cable designed for telephony might not be as hazardous as would at first appear; it could at least transmit telegraph signals at much greater speeds.

Long Distance Telephony. Heaviside. Lond. *Elec.*, Oct. 2.—A brief discussion of the proposal of Preece in the direction of long distance telephony and telegraphy. (See article on "Submarine Cables," The Electrical World, Oct. 17). Preece suggests bringing the two wires as close together as possible; this will reduce the inductance and at the same increase its permittance; this is the opposite direction to the one which the present writer has so often advocated, which is, that the inductance should be increased and the permittance reduced; he refers to his published papers where he has discussed the matter.

Hertz Wave Telegraphy. Lond. *Elec. Eng.*, Oct. 2.—Referring to Marconi's method (see *Digest* last week), it is stated that on hearing of this, Prof. Lodge invited the B. A. Section to witness in his laboratory an experiment in which at an hour's notice his assistant had arranged an apparatus to do an exactly similar thing.

Fire-Alarm Signals in Vienna. Chitil. *Zeit. f. Elek.*, Oct. 1.—The beginning of a descriptive article, including several plates showing the systems of wires.

Telegraphy in Europe. Lond. *Elec.*, Oct. 2.—A reprint of the table noticed in the *Digest*, Oct. 3.

Persian Gulf Cable of 1864. F. C. Webb. Lond. *Elec.*, Oct. 9.—An account of the laying of this cable.

Seeing by Electricity. Wageman. *Elec. Eng.*, Oct. 14.—A brief description of the results of his experiments. He has not yet been able to obtain instantaneous transmission and the object must therefore be immovable at least for one minute; the receiver shows "a sort of daguerreotype of a clear and distinct nature"; no trace of transmission of color was observed; he concludes that one wire is not sufficient for transmission; he uses three, one for the direct, one for the alternating and one for the combined currents.

Telephonic Problems. Wageman. *Elec. Eng.*, Oct. 21.—The first of a series of articles, the present one calling attention to the unsatisfactory character of the light rays as transmitted by means of selenium, owing to the fact that colored lights cannot be transmitted as much; he suggests that a chemical combination of selenium must be used, making it respond to lights of different wave-lengths.

Telegraph Offices in Buffalo. TERRY. *West. Elec.*, Oct. 24.—An illustrated description of the new offices of the Western Union Telegraph Company in Buffalo, which are claimed to be the finest in the United States.

Western Union Annual Report. Elec. Eng., Oct. 21.—Extracts from the reports for the year ending June 30, showing an increase in the gross earnings but a decrease in the profits.

Safety Fuses for Telegraph and Telephone Wires. STRECKER. *Elec. Rev.*, Oct. 21.—A reprint of an abstract of a paper noticed in the *Digest* July 11 and 25, giving more data than was given in the abstract in these columns.

Changes in the New York Telephone System. Elec. Eng., Oct. 21.—Descriptions of some of the changes which have been and are about to be made in the lower districts of the city.

Code for Official Vocabulary. West. Elec., Oct. 10.—A reprint of the circular issued by the International Bureau, noticed in the *Digest*, Oct. 10.

Military Telegraph in the Ashanti Expedition. Elec. Jour., Oct. 1.—A reprint of the article noticed in the *Digest*, Oct. 3.

MISCELLANEOUS.

Technical Education. Lond. *Elec.*, Oct. 9.—A reprint of a short article from Lond. *Engineering*. The latter journal of Oct. 9 contains a further communication by Wells.

Roasting Iron Ores. WEDDING. Lond. *Engineering*, Oct. 9.—A reprint in full of the recent paper noticed in the *Digest* Oct. 3 and 17.

Revolving Tower. L'Elec., Oct. 10.—An illustrated description of a proposition by Devic for the principal attraction for the Paris exposition of 1900; it is to be a tall towering building of about 25 stories, 115 metres high, made of steel and glass, illuminated with 20,000 incandescent lamps and 2000 arc lamps, the whole being mounted on a pivot and revolving at the rate of one revolution per hour.

International Congress at Geneva. L'Ind. Elec., Sept. 25.—The conclusion of the report of the proceedings, with abstracts of the papers; the paper and discussion here referred to have already been noticed in these columns.

B. A. Meeting. Lond. *Engineering*, Oct. 2.—A continuation of the reports of the proceedings, including abstracts of the papers.

Electricity in Naval Life. FISKE. *Elec. Eng.*, Oct. 14; a continuation of his serial.—A detailed, illustrated description is given of the helm indicator for indicating at certain places in a ship the exact position of the helm; the device is secured to the rudder-post and connected with any desired number of indicators; it consists of a strip of resistance-wire through which a current passes and over which moves a metallic contact connected to the helm; the indicators are galvanometers whose needles deflect to the right or to the left as this traveling contact moves over the resistance-wire, the movement of the needles being proportional to the movement of the helm. In the issue of Oct. 21 he describes the steering telegraph for communicating from certain places on a ship to the steering wheels by an indicator showing the position to which the helm should be put. The principle on which it depends is that contacts are moved over a resistance-wire carrying the current and the changes in this resistance included between the moving contacts are indicated on suitable galvanometers connected with the moving contacts; the operator at the transmitter also has a galvanometer, and moves his contact until this galvanometer points to the desired position, and he therefore always knows whether or not the apparatus is working properly; detailed diagrams are given.

Estimating the Power Factor in the Cost of Carbide of Calcium. PATTEN. *Prog. Age*, Oct. 1; reprinted in the *Elec. Eng.*, Oct. 21.—He shows that under the assumptions which he makes, the cost of power for producing one ton is the same as the price of 1 horse-power per year; to find the cost of carbide multiply the cost of lime per ton in dollars by 0.875 and the cost of coke per ton in dollars by 0.56, and add to their sum the cost of a horse-power per year in dollars, the result being the cost exclusive of labor, interest, depreciation, etc.; any amount of power continuously operated should produce an equal number of tons of carbide a year.

Manufacture of Calcium Carbide. MOREHEAD and DE CHALMOT. *Jour. Am. Chem. Soc.*, 18, page 311; abstracted in the *Tech. Quart.*, June-September.—It is a description of the process as carried out in Spray, N. C., and at Niagara Falls.

Suggestions for Inventors. Elec. Jour., Oct. 1.—A number of suggestions for electrical apparatus for which there said to be a need.

New Book.

POOR'S MANUAL OF RAILROADS FOR 1896 has been issued and is more complete and valuable than any of its predecessors. This year Poor's directory of railway officials has been incorporated in the manual; this, together with the section devoted to investment securities, renders the volume of exceptional value for reference to those specially interested. This year's volume gives the statements of 1208 street railway companies, with a capitalization of $1,375,000,000, besides statements of steam railways and industrial corporations, and statements of the debts of 1008 States, counties, cities, town, etc., all of which represent an aggregate investment of $16,475,000,000. The book is replete with valuable financial, commercial and other statistics relating to American railroads. It is published by H. V. & H. W. Poor, 44 Broad Street, New York, and its price is $7.50.

Medals.

Mr. Robert Grimshaw has ordered a series of silver and bronze medals to be awarded to those engineers, firemen and others, (1) Who stand the best examination on boilers, pumps and indicator practice, and (2) Whose engines, after being one year in their charge, are in the best condition.

The details of competition, names of judges, etc., will not be announced until the medals are delivered in the various cities, in each of which the medal is to be competed for. We understand that the contests will be held in New York, Philadelphia, Boston and other cities.

Self-Centering Carbon Holder.

A new self-centering carbon holder is being presented to the trade by D. H. Murray, 426 James Street, Syracuse. The "Moss carbon holder," as this device is called, is a decided improvement in carbon holders in that it is self-centering. All trimmers who have ever used this device state that they can trim a greater number of lamps with more facility than by means of the old style of holder, any carbon, crooked or straight, being readily centered. All companies using electric lamps would do well to carefully investigate the claims made for this holder, which it is stated has been received with considerable favor by those who have used it and seen it.

Storage Battery in Railway Work.

When the Union Traction Company, of Philadelphia, decided to extend its Chestnut Hill division, the question of additional power-supply necessarily became one of the most important to be settled. It was narrowed down to two methods; either a new power-house had to be erected or an accumulator sub-station installed, as the required addition to the existing feeder system would necessitate such an enormous outlay for copper as to render such a course commercially impracticable.

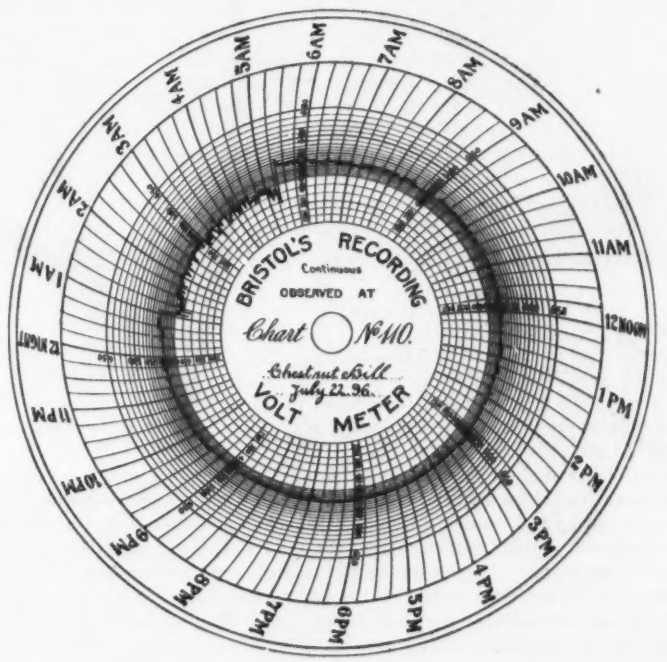


FIG. 1.

It was found that a storage battery plant sufficient to meet all the requirements could be installed for one fourth the cost of the copper that would be required to carry out the extension and double service on the line, and that a new power-house was out of the question on account of the heavy operating expenses. In view of these facts the storage battery seemed to offer the most practical and satisfactory solution of the problem, and a plant was therefore installed by the Electric Storage Battery Company. This plant is located at the end of a feeder, 11 miles long. Before the extension was made it was stated that the pressure at the ends of the feeder was barely enough to operate the cars on schedule time, and that the pressure varied as much as 50 per cent.

The accumulator installation consists of 248 cells of type "G" chloride accumulator, each cell containing 13 plates. The plates are contained in lead-lined boxes, mounted on two tiers of oil insulators, and the connec-

tions are made by continuous weld, no mechanical contacts whatever being used.

The maximum discharge of the battery is rated at 400 horse-power for one hour. The load on the section, it is stated, varies from 100 to 700 amperes; the feeder carries a constant load of 400 amperes, the battery discharging or charging to the extent necessary to maintain this condition. The result in actual practice is found to be that the feeder load remains constant at this average current, and is independent of the fluctuating demand on the line. The battery enables the generators to

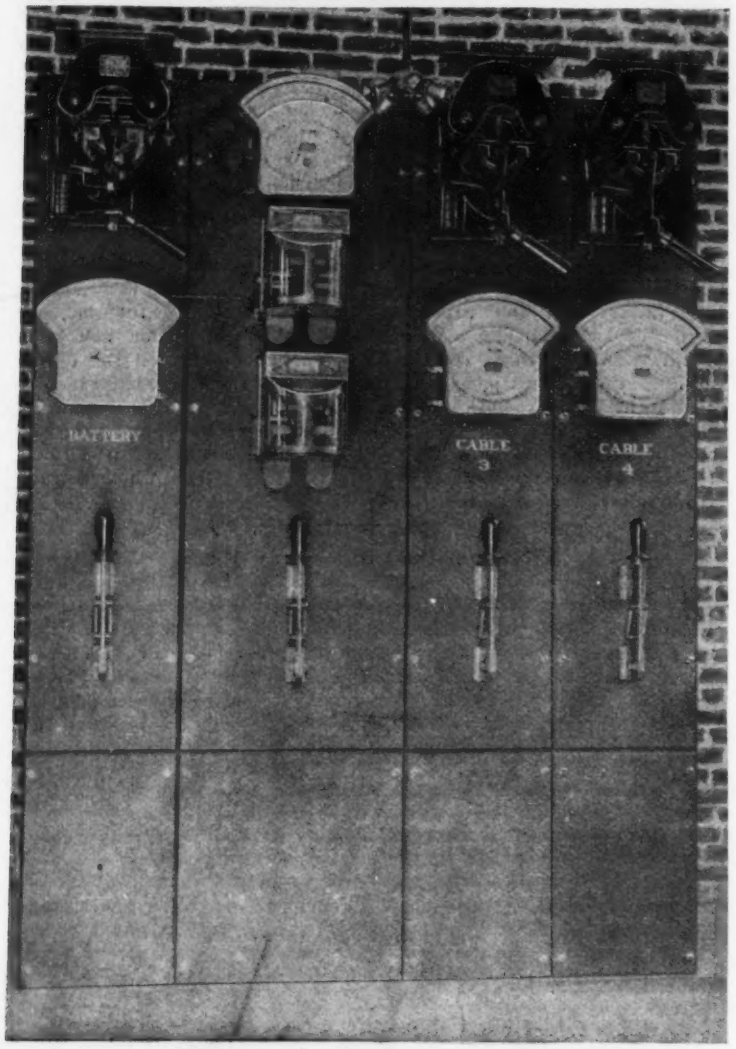


Fig. 2.

always run at full load and to act as a cushion to the engine in the event of the circuit-breaker opening in case of trouble on the line.

One of the most valuable features of the battery is to provide a reserve power-supply in case of break-down of the regular system, it being capable of carrying the total load for a short period.

The recording voltmeter chart (Fig. 1) illustrates the regulation of pressure resulting from the use of the battery. Between the hours of 1 a. m. and 5 a. m., during which period the battery is disconnected from the system, it will be noticed that the fluctuations are markedly wide.

A current curve taken under normal conditions show that the battery regulates to 200 horse-power, but it can be worked up to 800 horse-power in cases of necessity. Fig. 2 gives an illustration of switchboard which controls the battery plant.

A Broadside of Searchlights.

During the great sound money marine parade in New York Harbor, on the night of Oct. 24, Mr. S. W. Rushmore, of the Rushmore Dynamo Works, Jersey City, N. J., made a grand display of searchlights. Besides having over a dozen powerful lights on the vessels in the parade, there were erected on the roof of the seven-story Rushmore factory, which is opposite Cortlandt Street, New York, a solid line of 15 forty-ampere projectors of the latest type, and being on the water-front and over 125 feet above the level of the water, commanded every point in the city and harbor.

These lights were operated by skilled attendants who had been drilled to work them together to produce some beautiful effects, and the spectacle, as viewed from the New York shore, was very fine.

Power was supplied by a 250-hp Corliss engine driving a 110-volt Rushmore generator, which by day furnishes the power for the various departments of the works.

This display was one of the finest ever seen, each projector throwing an intense beam of light extending as far as the eye could reach, and in extent and grandeur exceeded anything of the kind ever before attempted.

It is stated that the same apparatus will be used in New York on election night to announce the result of the election, by flashes on the sky, which will be seen for miles in all directions.

Gas-Check Plug.

The gas-check plug of the "Pioneer" enclosed arc lamp is one of the most perfect gas-checking devices for limiting the ingress of air to the enclosed bulb. This plug or dead-air chamber consists of two parts so arranged as to serve as a reservoir for the gases produced by the arc, thus serving as a secondary chamber to the enclosing bulb. By the use of this plug the life of the carbon is greatly prolonged, and because of the stable condition of the enclosed gases, due to this secondary "dead-air" chamber, the light efficiency of the lamp is also increased.

The Electric Arc Light Company, New York, claims that by the use

Gas-Check Plug.

of this plug the "Pioneer" lamp has a minimum consumption of carbon per ampere, at the same time giving from 25 to 30 per cent. more light.

This result, however, is not the only advantage which follows from the use of the gas-check plug. This device is constructed so as to permit of the use of a moderately crooked carbon without interfering in any way with the uninterrupted service of the lamp and without affecting the amount of light produced or the life of the carbons.

Electrical Works, Bozen-Meran.

The cities of Bozen and Meran, Switzerland, determined to jointly utilize the water-power of the river Etsch, near Meran, and install a power station, for lighting and for the transmission of power to the two cities and their neighborhood. The plans and specifications of this enterprise were prepared by Mr. Oscar von Miller, of Munich. The contract for the electrical work was given to the firm of Ganz & Co. during the month of August of this year, while the water-works were constructed under the supervision of the architect, Amman, of Moedling, and are almost completed. The water-power of the Etsch is about seven kilometres from Meran, at the River Toell, and has a capacity of about 10 cubic metres per second, with a fall of 70 metres. The water of the Etsch is led off above the River Toell by means of a tunnel and led into a reservoir on an adjoining hill, which is used as a cleaning reservoir. This then leads under an angle of 45 degrees into a penstock, to which piping is connected, which latter leads to the power station right below Vintchgauer Street. The power house is laid out for six 1000-hp machines, each one of these units consisting of a Ganz Partial-Girard turbine, with horizontal shaft and automatic regulator connected directly to a rotary current dynamo of 660 effective kilowatts, with 360 revolutions per minute. On the wall of the power house a switchboard is placed in a wrought iron frame and base, the board being 18 metres long and containing all instruments and apparatus for the regulation of the machinery. The station will, for the present, only contain two units of 1000 horse-power, to which in the course of the year one more unit will be installed for a reserve. The line will consist of 6 copper wires for Meran and as many for Bozen, supported by triple petticoat insulators, mounted on larch poles 12 metres high. The distributing net in the cities goes by means of underground cables to distributing transformers, which are placed in the streets and public highways, and by means of bare wires to the outskirts of the cities on poles and in the cities on specially-mounted stands on the roofs of house. For the City of Bozen a total transformation is necessary on account of the high voltage. This is accomplished by leading the high-tension current of 10,000 volts through two rotary cur-

rent transformers of 350 kilowatts capacity, which latter are connected in parallel and will reduce the voltage to 3000, and with this tension the current is led into the network of the distributing transformers. The distributing transformers reduce the current from 3000 volts to 115, and this secondary distribution network is furnished to the consumer. The electricity works of Bozen-Meran will be turned over by next year, and in consequence of the rapid development of these two cities it may confidently be expected that it will soon develop to its full capacity, especially in view of the fact that the suburban roads of these cities intend to adopt electricity for their service.

A New Porcelain Insulator.

The accompanying cut, Fig. 1, represents in full size the new porcelain insulator manufactured by Fred M. Locke, Victor, N. Y. This insulator is made from the highest grade of hard porcelain ware and is designed for heavy lines which require a strong and durable support.

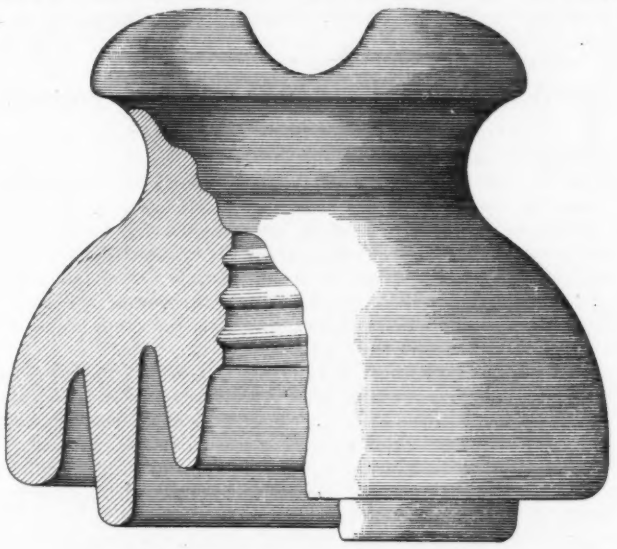


FIG. 1.—PORCELAIN INSULATOR.

The three petticoats on this insulator present a high insulating surface, which method of construction has proven so efficient in Mr. Locke's large triple-petticoat porcelain insulators for high-voltage power transmission.

The form of this insulator is such as to render it an easy matter to tie the cable and hold it securely in position.

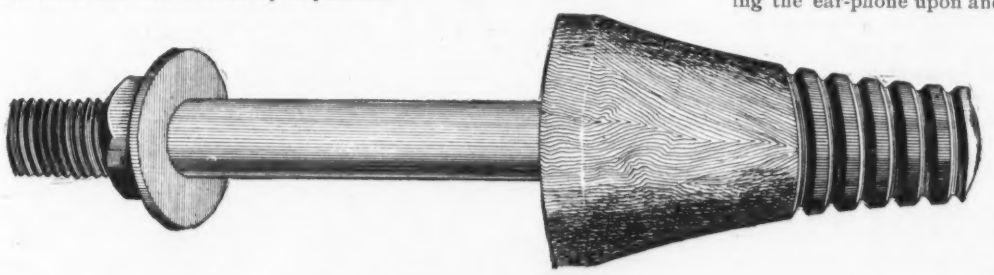


FIG. 2.—STEEL PIN.

Fig. 2 represents an illustration of the new heavy steel pin for street railway work which has been designed for use in combination with the insulator above described. This pin is claimed to be much stronger than any other pin on the market for this class of work, and satisfaction is guaranteed to those who use it.

A New Automatic Telephone Switch.

When the fundamental patents on the Bell Telephone receiver expired, on March 7, 1893, and when the validity of the now famous Berliner microphone-transmitter patent of Nov. 17, 1891, was placed in doubt by the suit brought by the United States Government against the American Bell Telephone Company for its annulment, it was generally supposed that the telephonic field would soon be thrown entirely open to the public. It was, however, soon discovered by many of the "independent" telephone manufacturers and operating companies who sought to take advantage of the patent situation by supplying the market with telephonic apparatus in competition with that of the parent Bell Company and its licensees, that the expiration and threatened annulment of these basic patents did not give them the immunity from litigation that they had looked forward to, but that the Bell Company still possessed valid patents on another essential feature of a telephone system, which they were not slow to enforce against infringers, much to the cost and embarassment of those who, possessing types of telephone apparatus of their own, sought and are still seeking to enter the coveted field.

The additional patents alluded to, upon some of which a number of suits have been recently instituted and successfully maintained by the Bell Company, are those known generally as the gravity-hook telephone patents. These patents—which have been heretofore referred

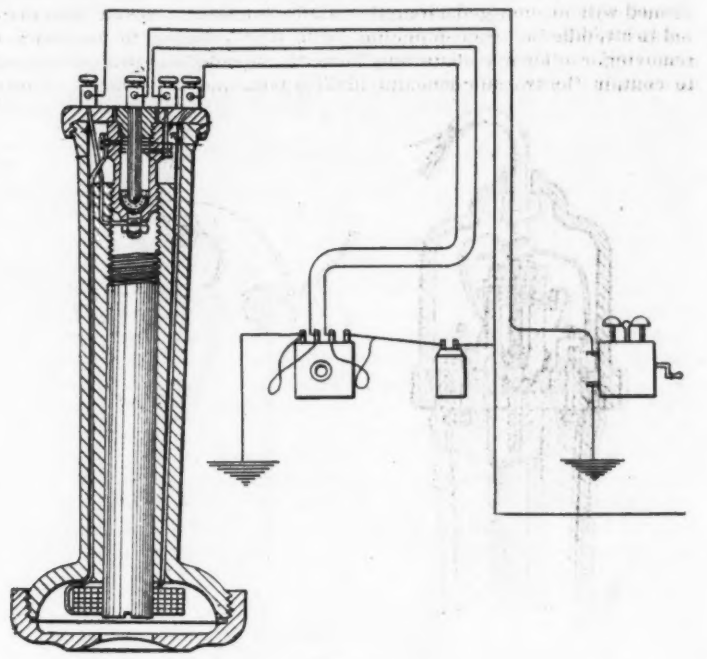


FIG. 1.

to in our columns at various times*—cover the various types of automatic switch devices in general use, by means of which the subscriber's circuit connections are automatically changed from the signaling to the speaking condition and *vice versa*, by the act of removing the receiver from and replacing it upon its hook. Among the controlling patents of this class still in force are those of Watson, No. 270,522, granted Jan. 9, 1883; Warner, 284,102, Aug. 28, 1883; Phelps, 222,201, Dec. 2, 1879; Gilliland, 242,195, May 31, 1881; Scribner, 248,671, Oct. 25, 1881; Carty, 449,106, March 31, 1891, and others, all relating to various types of telephone hook switches in which either the weight of the receiver, acting through a spring-opposed switch lever, or the force exerted by the hand in placing the ear-phone upon and removing it from its hook, or the electrical contact established between the telephone ring and its hook, serves as the operating agency.

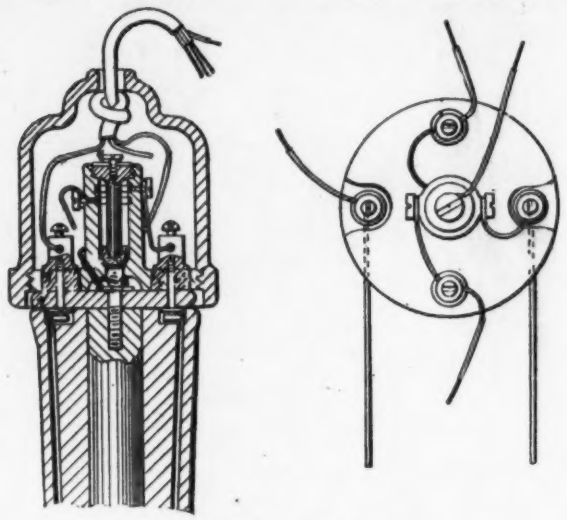
Although numerous attempts have been made by inventors to devise a practical form of switch which would overcome the claims of these patents, these attempts do not appear to have hitherto resulted in successfully meeting all the requirements. We illustrate this week, however, a novel and ingenious type of telephone switch, forming the subject of a patent granted to Mr. Elias E. Ries on Sept. 15, 1896, which is claimed to be not only non-infringing, being a departure from the conventional type of gravity-switches, but which appears to possess a number of decided practical advantages pecular to itself. The switch employs no lever or springs and is entirely self-contained, forming part of, or being attached to, the telephone receiver itself. The circuit-changing medium consists of a small quantity of mercury enclosed within a non-conducting thimble of hard rubber or equivalent material, the arrangement being such that the act of lifting the receiver to the ear will automatically cause the mercury to cut out the calling circuit and cut in the receiver coil and the transmitter, thus placing the circuits in the proper condition for conversation, while the dropping of the receiver or the act of standing or placing it in its normal or vertical position will instantly restore the connections for calling by causing the mercury, which is acted upon by gravity, to cut out the transmitter and receiver and to cut in the magneto or signaling circuit.

By referring to Figs. 1, 2 and 3 it will be seen that the switch thimble is provided with a lower cup-shaped contact-surface and two upper slightly separated contact-rings of iron (a metal that is not attacked by the mercury) which are imbedded in the wall of the thimble during the process of molding or forming, the latter so that their inner or contact surfaces are

* See THE ELECTRICAL WORLD of Dec. 29, 1894, page 662, Jan. 12, 1895, page 43, and Nov. 9, 1895, page 512.

flush with its interior. The mouth of the thimble, after introducing the mercury, is closed by a one-piece, adjustable, threaded iron plug having an inwardly-extending elongated contact-stud in line with the longitudinal axis of the receiver, its external portion forming at the same time the main-line binding post.

The switch thimble may either form an integral part of the telephone receiver casing, or it may be separately formed for ready attachment to receivers already in use. In the latter case, the thimble is preferably formed with an enlarged, circumferentially threaded, recessed base adapted to straddle the receiver binding-posts, (thus avoiding the necessity of removing or otherwise disturbing them) the threaded base being designed to contain the two supplemental binding posts and to support a removable protecting cover or hood containing an opening for the passage of the conducting cord. The binding-posts, of which there are four, are suitably connected with the switch-contacts and the receiver coil,and, by means of a flexible four-conductor cord, with the transmitter, call-bell, battery and line as shown diagrammatically in Fig. 1.



Figs. 2 and 3.

When the telephone is in its normal or vertical position, as in Fig. 1, the mercury is in the bottom of the switch thimble and connects the central or main-line stud with the lower cup contact which leads to the call bell. The receiver coil and transmitter are open-circuited by reason of the absence of the mercury from the two upper contact-rings. Consequently, the connections are in condition to receive a call. If, now, the receiver is picked up and held to the ear in the customary manner, the mercury will at once run toward the opposite or upper end of the thimble, as shown more clearly in the detail view, Fig. 4, breaking connection with the lower contact cup and establishing the connection between the main-line stud and the two upper contact-rings that surround it. In this position the magneto circuit is cut out and the connections placed in the proper condition for conversation by the cutting in of the receiver, transmitter and battery.

Should it be desired, as is frequently the case, to repeat a call to "central," it will not be necessary, as under the present system, to remove the 'phone from the ear and to again hang it upon its hook in order to restore the calling connection, but instead a slight momentary elevation or tilting of the ear 'phone while still engaged in listening is all that is needed. This is an important advantage, since it not only avoids the risk of missing an answer to the original call, but saves a great deal of valuable time both to the subscribers and the central station. Another advantage over the gravity-hook system lies in the greater simplicity, convenience and promptness of the switch and the more rational and natural manner of using it. One has but to carry the 'phone to the ear, much in the same manner as he would the flexible end of a speaking-tube—almost without previous instruction—in order to use it properly, and without reference to its replacement upon a circuit-restoring hook and the possibility of and serious results attending failures to do so. Since the switch is self-contained within the receiver, which latter may normally remain suspended freely by its cord, or, if preferred, supported by a dummy hook, the separate switch-lever contact mechanism and wiring can be dispensed with and the stationary apparatus thereby simplified. The principle of the switch is such that it can be applied to any type of telephone receiver or condition of telephone circuits, at less cost than existing types of switches and it is also applicable to other than telephonic purposes.

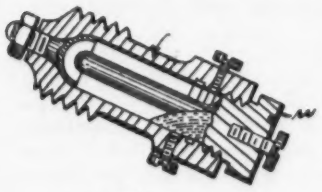


Fig. 4.

We understand that the switch has been tested and found eminently satisfactory in operation, and that the reliability of the mercury contact has been thoroughly established, and has in fact proven superior to the usual spring contacts on account of the more perfect connection due to the fluidity of the mercury and to the broader area across which the current travels. According to the patent specification it has been found that the addition of a little graphite to the mercury, sufficient to just form a light film or coating over the surface of the globule, is an advantage in further increasing the efficacy of the electrical contact, and that excellent results have also been obtained from the employment, in lieu of mercury, of small-sized lead shot and other finely divided conducting matter.

It will be apparent that inasmuch as this simple device dispenses entirely with the use of the supporting hooks, pivoted arms, switch levers and contact springs, which comprise the essential elements in the formidable group of telephone-support patents under which the telephone business of the country is still being successfully monopolized, the claim that the Ries switch is non-infringing seems to be well founded. The issue of the patent at this time will therefore prove of special interest to those who are seeking to enter the telephonic field, and particularly so as its intrinsic merits give promise of making it the standard type of telephone switch, at least until other patents designed for the same purpose have expired.

Electrical Omnibuses and Other Vehicles in England.

The impression seems to have gotten abroad in certain quarters that electrical and other horseless omnibuses, wagons, carriages, etc., are somewhat extensively used upon the streets of London. The truth is that up to the present such a thing as a horseless carriage is a very uncommon sight on London streets, and when it does by chance appear, in opposition to our present law, it is followed by a huge and curious crowd. About the only users of motor cars at present are those who obtain special permission for specified journeys, and those who are fined for committing a breach of the Locomotive Acts.

A few weeks, however, and this may all be changed. The long-desired legislation has been secured, for the "Locomotives on Highways Act of 1896" comes into force on Nov. 14. Upon that day various manufacturers will place upon the streets motor-cars good, bad and indifferent.

It is difficult to say in which category the electrical vehicle will range itself; trials and probabilities point in the direction of indifference, but the events of the next few months may show that electrically propelled conveyances acquit themselves very favorably. Whether or not this turns out to be so, a great effort is being put forth by those interested in electrical work, and particularly this branch of it, to leave no stone unturned to enable electricity to take a leading place "among the powers." Particularly is this the case in regard to omnibuses, for the arrangements in hand are somewhat extensive, and if statements now made are acted upon we shall very shortly have at least a couple of hundreds of these electrical omnibuses running in London and a good number also in provincial districts.

Under the new legislation these vehicles will be defined "light locomotives," and must not exceed four tons in weight unladen, *i. e.*, exclusive of "water, fuel or accumulators used for the purpose of propulsion." These vehicles, if under two tons laden, will be subject to an excise duty of 2 guineas, and if over two tons unladen the duty will be 3 guineas. The highest speed allowed by the act is 14 miles per hour, but this will probably be modified in many cases by the Local Government Board, which has power to make any additional regulations it may consider necessary for the proper protection of the public, but which are not already mentioned in the act.

Of course in connection with the question of serviceable electrical omnibuses, the whole matter turns upon the old requirement of a thoroughly good secondary battery. Several good batteries are manufactured in England, all of which naturally claim to be the best out for traction purposes. One of the new bus companies is to use the E. P. S. batteries, another a new type of Epstein cell, and another the Solar accumulator or any better one that happens to come along. It seems, however, that the long-sought-for battery, which will be economical, of very light weight, high capacity, and stand a fair amount of jolting and knocking about, so as to be suitable for such heavy and precarious roadwork, has yet to introduce itself; and this want seems at present to be the one great point which will hinder the progress of electricity in this direction.

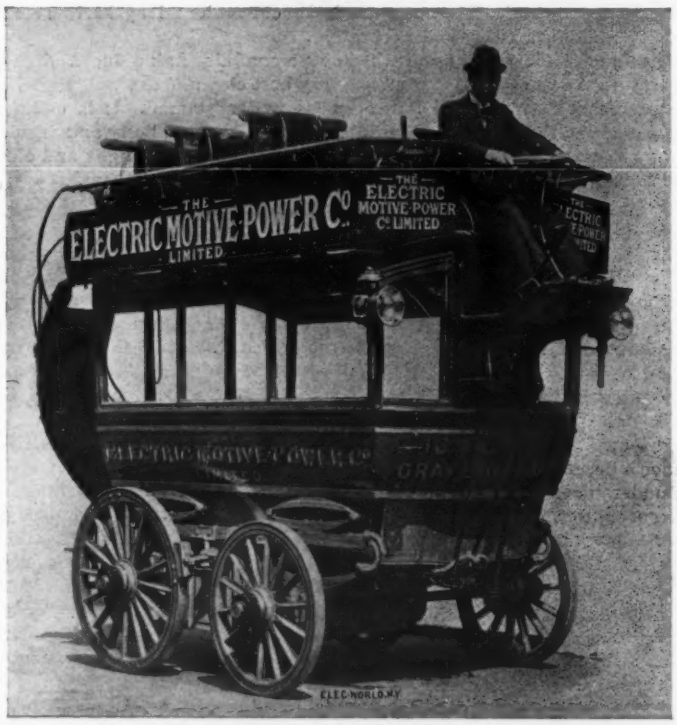
An electrical omnibus built by the Electric Motive Power Company, Ltd., of London, is shown in the accompanying illustration. This company has had over four years' experience in the experimental construction of such conveyances, and is also laying down special works for the manufacture of electric dustcarts, vans, wagons, etc. The van is shown as it has several times appeared in London and the provinces, and as it will be when turned upon the streets for regular service in November. This bus has been running for some months in the country, in the neighborhood of St. Albans and Hatfield. Its weight comes well within the margin allowed, for it is only 2 tons, 14 cwt., including the batteries, which weigh 15 cwt. by themselves. There are 52 cells in all, arranged in four trays under the seats inside the bus. They slide in and out at the front of the vehicle. Trials were made by the company of various types of accumulators, and it was considered that a new form of Epstein battery with a grooved plate to give increased surface was the most suitable.

The company has therefore entered into an arrangement with the Epstein Electric Accumulator Company under which it has the sole right for the use of this type of battery in omnibus work. With these 52 cells the bus is equal to a 10-mile run, and therefore is suited for any of the usual London routes, such as from Liverpool Street to Putney. Arrangements will be made with the electricity supply stations for re-charging, spare sets ready charged being kept by so as to prevent delay. This, while being of great assistance to the bus companies who run the vehicles, will also benefit the station owners by adding to the dayload.

The system of springs upon which the body is suspended is stated to be well protected from vibration, and through all the trial runs which have been made not a drop of acid has been spilled, though it comes within half an inch of the top. Many kinds of steering gear were tried during the four years the company has had the matter in hand, and the best has been selected. Chain-gearing was considered satisfactory. The special power-gear provided will enable the vehicle to ascend heavy gradients, this gearing being contained in a dust-proof box 12 inches long.

It is claimed that the cost of propelling this bus is only 2d. per car mile, calculating at the rate of 4d. per Board of Trade unit, which the supply companies will probably charge.

Another company—the London Electric Omnibus Company—is constructing an electrical omnibus for 26 passengers, which is intended for the London traffic, and it was recently stated that shortly this company alone will put 200 such vehicles upon the London roads. As the first is not yet quite completed, though the company commenced operations in May last, it is impossible to forecast when this large number will be seen in operation. Mr. Radcliffe Ward, the engineer of the company, has been experimenting for the last six or eight years upon his system, and this year the company was formed to put it into actual practice. In the course of his tests Mr. Ward ran his bus over a distance of 5000 miles, and calculating upon the figures resulting from these tests, which cover, as stated, a number of years, the company reckons that on its system the



ELECTRICAL OMNIBUS.

vehicles will run more economically than horse systems. It even goes to the extent of quoting the following:

Horse traction, 5.32d. per mile.

Electric traction (Ward system) 2.44d. per mile.

The latter figure will doubtless be exceeded when the rough handling of the ordinary running shows its effect. The company has its own type of accumulator, but is open to use a better when it is procurable in the open market. Particulars of the battery, gearing, etc., are not yet disclosed. The bus has a special form of gearing. This same company has also designed on Mr. Ward's system a victoria supplied for the King of Spain.

Among the companies preparing for the manufacture of electrical buses and carriages are the Great Horseless Carriage Company, which owns also a number of valuable patents for petroleum and other systems; the Universal Electrical Carriage Syndicate and the British Motor Syndicate.

The Bersey carriage, made by the Universal Electric Carriage Syndicate, is arranged to convey four passengers. It is fitted with a 2½ to 3-hp electric motor, current for which is supplied by 32 International electric storage cells of the A Y type. Easily manipulated steering gear, acting on the front wheels, is provided within convenient reach of the driver while a regulator is fitted which enables the carriage to be propelled at any desired speed. The motor is located underneath the rear seats, the power being transmitted to the rear wheels by chain gearing. The maximum speed is from 14 to 15 miles per hour, and the weight of the carriage 15 cwt.

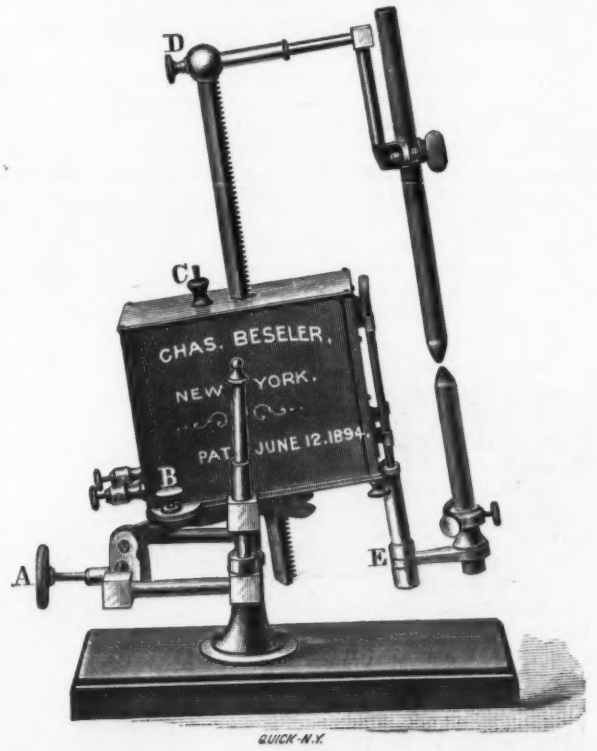
The Garrard & Blumfield carriage has its framework built entirely of weldless steel tubing. The four wheels are 24 inches in diameter and are fitted with four-inch pneumatic tires. The electrical energy for the motor is stored in a battery of 24 I. E. S. cells of the A Y type under the seats. The motor, which is of 1½ hp, is arranged about the centre of the framework below, the power being transmitted to the rear driving wheels by chain gearing, through the intermediary of friction discs. A. B.

Arc Lamp for Magic Lanterns.

Charles Beseler, 218 Centre Street, New York, manufactures an electric arc lamp for magic lanterns which possesses all the modern improvements in this class of apparatus. It is adaptable to almost any style of magic lantern, and in action the light is very steady and almost noiseless. It is provided with ingenious devices for obtaining any necessary adjustment for setting the carbons and controlling the arc. The latter is regulated by means of a ratchet and pinion movement, as shown in the accompanying illustration, from which it will be noted that the movement of the carbons is universal. The adjusting features of the lamp are complete and permit of very accurate work.

The lamp movement is enclosed in a metallic case made of hard sheet brass highly finished and oxidized, while the other parts are nickel-plated. The entire lamp is mounted on a walnut base 4 x 12 inches in size, and the height of the lamp to the centre of the condenser is 6 inches; complete and ready for use it weighs 7½ pounds.

The movement and regulation of the carbons are effected by a simple



ARC LAMP.

mechanism contained in the case. The pinion on which the carbon ratchet engages and a wheel with a grooved periphery are fixed to a common shaft. Around the groove is a small chain cord which is slackened or tightened by the action of the magnet which is in shunt with the carbons, the tightening of the cord acting as a brake on the wheel. When the arc becomes too long, and consequently increases the resistance, the shunt magnet acts and slackens the cord around the wheel sufficiently to allow the ratchet and carbon to drop by gravity. When the proper length of arc has been struck the magnet armature falls away, and by so doing tightens the cord around the brake wheel, thereby arresting all further downward motion of the carbon. This method of regulating the carbon is free from the uncertainties of action inherent in clockwork, and is claimed to be more sensitive and accurate, besides being much simpler.

Another important feature of this lamp is the facility in keeping the arc central. This is effected by turning the thumb screw *A*, which elevates or depresses the rockers underneath the case according to the direction in which the screw is turned, and in this way the lamp and carbons altogether are raised and lowered so that it is an easy matter to bring back the arc to the centre when its central position has been dis-

placed by reason of the consumption of the lower carbons. This feature of this lamp is a valuable one and is claimed to be superior to anything yet devised to accomplish the same result. It is said to be better than the automatic feeding of the lower carbon. For lateral adjustment the thumb screw *B* is loosened and the lamp set according to requirements. The carbons are very easily adjustable by means of the swinging joints, and for the regulation of the arc according to the current and nature of the carbons the spring *C* is provided, which increases or decreases the tension on the armature lever.

Mr. Beseler also makes a hand regulating arc lamp which is extremely simple and effective in practice, and his photograph studio hand arc lamp is as well a very simple piece of mechanism permitting of the regulation of the light within a wide range. The current to all lamps is regulated by a rheostat which has the effect of increasing or diminishing the light, and the facility with which the lamps are regulated enables the operator to get a perfect light on the screen free from all blemishes on the outer edges. Cored upper carbons are used in these lamps, the lower ones being solid.

These lamps are used in several of the leading institutions of learning, including Columbia College; American Museum of Natural History; the College of the City of New York; American Institute, New York; Society of Amateur Photographers; Brooklyn Institute, and several others.

In addition to these lamps Mr. Beseler manufactures stereopticons, magic lanterns and all the accessories therefor, and all of his goods have a reputation for reliability and excellence of make and finish.

Mr. Beseler's factory, which occupies the entire four-story building, is completely equipped with modern machinery, and he has every facility for the production of first-class apparatus. Every lantern is tested before it leaves the factory so that when the purchaser receives it he receives with it a guarantee that it will do its work under the proper conditions.

Alternating-Current Motors for Sewing Machines.

Owing to the increasing use of alternating currents in electric lighting, there has sprung up a demand for a sewing-machine motor adaptable to this system, and to supply this demand the Kent Electric Manufacturing Company, Worcester, Mass., has designed a motor of this class, of which an illustration in connection with a sewing machine is given herewith. The great difficulty encountered in applying alternating-current motors to sewing machines has been that their starting torque is so small that they will not start readily with a load, and another trouble experienced has been the difficulty of varying the speed. Both of these features have been met by the Kent motor. The motor is of the induction type, with neither commutator nor brushes, and is mounted on a base to

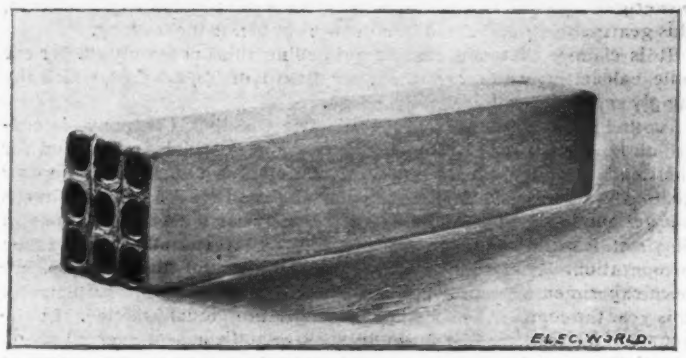
Electrically Driven Sewing Machine.

move with a lever connected with the treadle of the sewing machine. It is provided with a switch which is turned on when the operator sits down to the machine. The motor pulley is running constantly when the machine is in use and the speed of the machine may be varied from the lowest to the highest by merely moving the treadle. Upon shutting off the power a brake is applied to the balance wheel which stops the latter almost instantly. The motor is finished in black japan with nickel trimmings, and it is believed that to some extent these motors will meet with a large use for the Summer fan trade.

Vitrified Clay Conduit.

The vitrified clay conduit, manufactured by the H. B. Camp Company, Aultman, O., is growing in favor among electric companies who are compelled to place their wires under ground. A brief description of this conduit will no doubt be of interest to our readers.

The composition of these conduits is vitreous and ensures excellent insulating qualities and at the same time it is acid, gas and water proof. These sections of pipe are mechanically strong and resist any ordinary pressure or blow that might accidentally be received, and are easy to



Section of Vitrified Clay Conduit.

lay and economical. They are made in convenient lengths to secure ease of handling rapidly and accurately.

The illustration given herewith shows a conduit of nine ducts. These conduits are manufactured from the very best clay and are well made. It is stated that they will last for centuries under ground. It is claimed for them that they combine strength, durability, simplicity and insulation, and many of the most prominent telephone, electric light and electric railway companies throughout the country are using them.

Electricity in Dentistry.

The applications of electricity to dentistry have increased at such a rate within the past few years that those not directly interested in this line have as a rule but a meagre idea of its scope. The following article will give a partial idea at least of some of the dental apparatus now being manufactured by the S. S. White Dental Company, of Philadelphia, Pa.

The outfit shown in Fig. 1 practically covers all of the specialties, hence a description of it and its component parts will suffice. It must be understood, however, that different outfits comprising more or less of the specialties are to be had, and that the arrangement of the motor or the use of a stand or bracket dental engine may be had at the purchaser's desire. Current from any direct-current incandescent socket may be used, or in its absence, batteries may be employed. The current is regulated by appropriate resistance, and in order that the dentist may have both hands free and yet have complete control of his engine, the current is controlled or cut out altogether by means of a foot-treadle, as shown in the figure. It consists of an iron box containing starting, stopping and reversing clutches controlled by two rocking pedals on top and a toe lever which curves over the front of the box and operates the speed regulating resistance of the stand. At the rear of the box is a large corrugated pad for the heel of the operator's foot. The rocking pedal to the left stops and starts the motor and governs the clutch. Pushing down the inner knob starts the motor while pushing down the outer stops it. Still greater pressure on the outer knob throws in the clutch and instantly stops the tool. The right pedal controls the direction of running; with the outer knob pressed down the tool runs to the left, and by pressing the inner knob reverses the current in the field magnets and the tool runs to the right. The toe lever which operates the variable resistance governs the speed of the apparatus. Pushing the lever to the right increases the speed. In conjunction with this speed apparatus is a pulley having two grooves, by the use of which in combination with the variable resistance controlled by the pedal, any speed from 700 to 5000 revolutions per minute can be had. This motor has also two collecting rings from which alternating current is taken, it being in fact a little rotary transformer. The alternating currents are fed to a static transformer shown in the upper part of the illustration, and from the secondary of this instrument currents are obtained for the hot-air syringe, the electric light, mallet and cauterizing devices. It is therefore obvious that it is easy to so arrange a transformer as to have absolute control of the volume and voltage of the secondary current.

The hot-air syringe is shown in Fig. 2, and consists simply of a platinum

coil placed in the glass nozzle of an ordinary syringe. Two wires enter the rear of the bulb, and a suitable device is placed in the nozzle, whereby the pressure of a button closes the circuit, and by properly manipulating it a blast of air can be obtained at any temperature from that of the room to the warmest that the patient can stand.

Fig. 3 illustrates the lamp for illuminating the mouth and making an examination. Its brilliancy is controlled by the sliding contact ring on the handle. A mirror allows otherwise invisible portions of the mouth to be viewed. It is said that with this lamp it is much easier to detect decay or foreign substances; a sound tooth appears translucent without variations, and any opaque spot either indicates dead pulp or a thickening of the tissues, which is the forerunner of decay. It is also of assistance in determining the proper depth to make an excavation in the tooth, and when this operation has proceeded far enough.

FIG. 1.—DENTAL OUTFIT.

In Fig. 4 is illustrated a hammer to be operated by direct current.

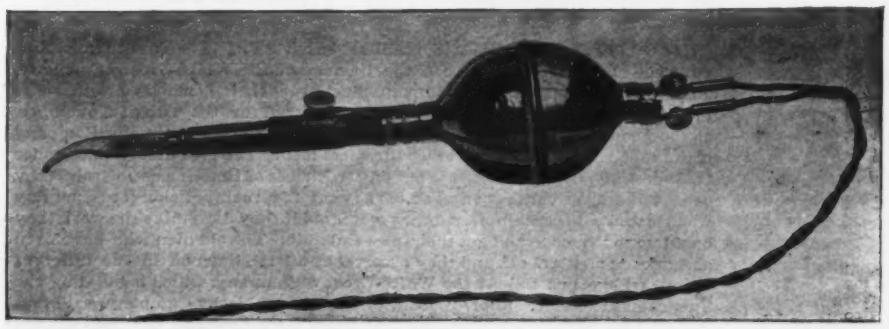


FIG. 2.—HOT-AIR SYRINGE

Tools of the customary shapes are provided to fit in socket and to the piece carrying this socket the blows of the hammer are imparted by the magnet, *E*. The finger is placed through the ring, *B*, and pressure on the little clip, *C*, starts the hammer. By means of adjustments the blows of the hammer may be varied either in frequency or intensity to any degree desired. It is said that with this hammer gold may be filled in cavities with delicate walls which would be liable to be fractured by the ordinary processes. At the same time the work is done so rapidly and thoroughly that both the patient and the operator are less fatigued. All of this apparatus is thoroughly well made. The motor is protected by a glass bell jar. In the transformer device the use of the secondary current, which is absolutely isolated from the primary current, obviates any danger of high voltages in the mouth. Several of the accessories, as the mallet, the mouth lamp, hot air syringe and cautery, can be operated by batteries, one of which used for this class of work being the Partz acid gravity battery.

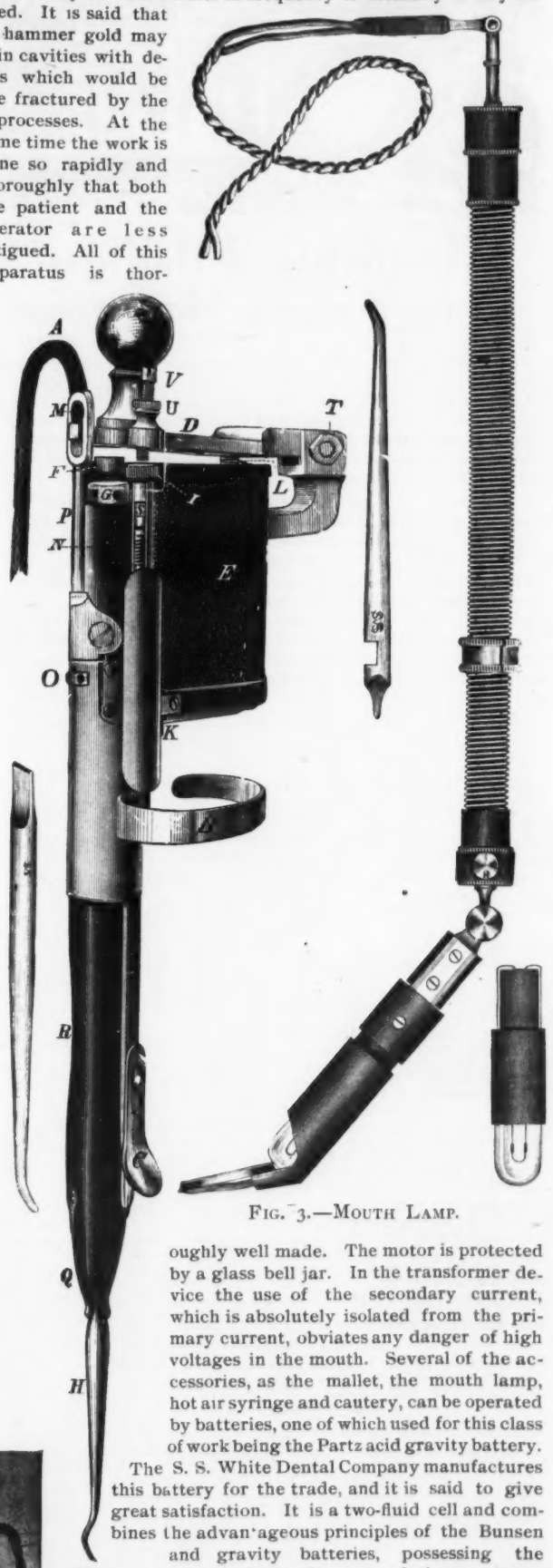


FIG. 3.—MOUTH LAMP.

The S. S. White Dental Company manufactures this battery for the trade, and it is said to give great satisfaction. It is a two-fluid cell and combines the advantageous principles of the Bunsen and gravity batteries, possessing the energy of the former and the constancy and durability of the latter. It furnishes a practically constant current until the fluid is completely saturated with the products of the chemical action, and at any time during this period the addition of a little salts in the tube will immediately restore its strength in case it shows any signs of weakening. The jar is filled with a solution of common salt; the sulpho-chromic salt is introduced through the tube, and being heavier than the solution of common salt, sinks to the bottom and prevents the polarization of the carbon plate. The zinc plate is the only one that is consumed, and with proper care it will last for years. The battery will remain on open circuit without consumption of the zinc and is always ready for use.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Oct. 24, 1896.

ELECTRICAL STOCKS.—A better feeling seems to have pervaded the general electrical stock market during the past week, and advances are generally reported. General Electric closed the week with a net advance in price of 2¼. The highest price of this stock was the closing price, namely, 28⅛. Edison Electric Illuminating of New York closed at 92½, which is 1 point below last week's closing quotation. Westinghouse securities were quiet in Boston, the closing prices being practically unchanged from last week.

TELEGRAPH AND TELEPHONES.—A generally stronger market existed for this class of securities during the past week. Bell Telephone enjoyed a net advance of 3 points. Erie Telephone also closed at advanced quotations as compared with the week previous.

TRACTIONS.—Inactivity characterized the dealings in traction securities, although there was an evident better tone. The net advances exceeded in number the losses, and in some cases substantial advances are recorded, notably New Orleans, common and preferred, and North Shore Traction preferred. Worcester Traction securities also showed some special activity and advanced 1 point for the common and 3 for the preferred. Columbus Railway and West End preferred are recorded with slight declines.

STOCK LISTED.—The stock of the American Electric Heating Corporation of Boston has been placed in the unlisted department of the Stock Exchange in that city.

LARGE MORTGAGE.—The Detroit Telephone Company, Detroit, Mich., has mortgaged its franchises and other property to the Central Trust Company of New York, for $600,000 at 6 per cent. interest. The period of the mortgage is to Feb. 1. 1922. When the subscribers to the telephone company number 6000, $100,000 more bonds may be issued and for each additional 1000 subscribers thereafter $100,000 of bonds may be issued until the aggregate reaches $1,000,000.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	..	..
Edison Electric Ill., New York	100	92½	95
" " " Brooklyn	100	88	93
" " " Boston	100	..	..
" " " Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	27¼	27½
Electric Storage, pref	100	29⅞	30
General Electric	100	28⅜	28½
General Electric, pref	100	64	67
Westinghouse Consolidated, com	50	..	24
" " pref	50	49	50
BONDS.			
Edison Electric Ill., New York	105	..	106½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	88½	..
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	205	205½
American District Telegraph	100	*29	39
American Telegraph & Cable	100	90	91½
Central & South American Telegraph	100	124	127
Commercial Cables	100	140	..
Erie Telephone	100	60¼	..
New England Telephone	100	94	..
Postal Telegraph-Cable	100	78	80
Western Union Telegraph	100	85¼	85⅜
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	16⅞	17
Brooklyn Rapid Transit		19¾	20¼
Brooklyn Traction	100	..	14
" " pref	100	46	48
Buffalo St. Ry	100	66	69
Cleveland Electric Ry	100	..	..
Columbus St. Ry	100	39	41
Hestonville	100	48	48½
" pref		..	62½
New Orleans Traction	100	6	9
" " pref	100	35	45
North Shore Traction	100	20	25
" " pref	100	72	75
Rochester St. Ry	..	16	18
Steinway Ry	..	45	50
Union Railway (Huckleberry)		98	103
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	67¼	67¾
" " pref	100	89	90
Worcester Traction	100	16	19
" " pref	100	88	92
BONDS.			
Brooklyn Rapid Transit 5s. 1945	100	73	..
Buffalo St. Ry. 1st con. 5s	100	105	*107
Cleveland Elec. Ry. 1st mtge 5s	100	100	*103
*Columbus St. Ry. 1st 5s	100	90	*95
Rochester St. Ry. 1st 5s	100	..	98
Union Railway (Huckleberry) 1st mtge 5s		100	*103
*Westchester Electric 1st mtge 5s	100	100	103

* With accrued interest

BINGHAMTON RAILWAY COMPANY.—The comparative statement of the Binghamton Railway Company, Binghamton, N. Y., for the quarter ending Sept. 30 last. shows receipts of $46,193.34 and operating expenses $19,957.46, leaving a balance of $26,235.88. The gain in receipts as compared with those during the same period in 1895 was $5,304.21 and the increase in net receipts $3,699.16. A comparative statement for the five years ending the same date, shows a steady increase of receipts and net earnings. For the last year the receipts were $141,339.34 and operating expenses $79,013.33, leaving the net receipts $62,326.01. From this is deducted the taxes, amounting to $3285, leaving a balance of $59,014.01. The percentage of operating expenses to receipts was 56 per cent., which is lower than it was during any of the five years covered by the statement.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Oct. 26, 1896.

MR. L. E. FRORUP, general sales agent of Schiff, Jordan & Co., 39 Cortlandt Street, has taken an extensive Western trip in the interest of his house. Reports have already been received of his having met with success thus far.

FIRE UNDERWRITERS.—The Electrical Bureau of the National Board of Fire Underwriters has just issued an index to laboratory reports, from Nos. 1 to 500. Mr. William H. Merrill, Jr., is the electrician for this board. The index will no doubt be of value to those interested in these matters.

TO WITHDRAW OPEN CARS.—The electric railway companies have been ordered by the Health Commissioner to cease running open cars. Severa complaints have been made to the Mayor lately about these cars and the authorities have determined to press the matter as speedily as possible.

LINEMAN ACCIDENTALLY KILLED.—Charles Bullinger, a lineman of the Manhattan Electric Light Company, fell from the ledge over the sixth story of Bellevue Hospital on the night of Oct. 4 and was instantly killed. He was engaged with other men in the repair of electric wires and having finished their work, Bullinger was in the act of passing tools to the window of the sixth floor when he fell.

EAST RIVER TUNNEL.—A hearing was held before the Aldermanic Railway Committee in the City Hall, Brooklyn, on Oct. 20, on the application of the New York & Brooklyn Railway Company for a franchise to construct a tunnel between New York and Brooklyn under the East River. The project has already received the approval of the New York Board of Aldermen and Mayor Strong. The application before the Brooklyn committee was not opposed. The plans call for a terminal station in Myrtle Avenue and Adams Street, Brooklyn. The matter will be further considered by the full board.

NAVAL PARADE.—On Saturday night, Oct. 24, a novel feature was introduced into the campaign in New York in the form of a "Sound Money" marine parade. Over 200 steamboats of all sizes and classes formed a long line, starting from 130th Street, North River, passing around the Battery up the East River to Thirty-Fourth Street, where the fleet was disbanded. Electric lights of all colors and searchlights were very liberally employed in the illumination of the flotilla, and many of the decorations were very attractive. One boat carried an electrical sign, by which words and expressions of a political nature were spelled out letter by letter, for the information and entertainment of the multitudes of people who lined the shores and occupied the roofs of prominent buildings. The weather was beautiful, and this fact lent much to the great success of the affair.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., Oct. 23, 1896.

PLANT TO BE ENLARGED.—The interesting announcement is made that the Calcium Carbide Company, which has a large plant on the lands of the Niagara Falls Power Company, will build an addition 75 by 100 feet in dimensions. Other improvements are expected to be made in the same district in the near future.

NIAGARA POWER TRANSMISSION LINE STRIKE.—No settlement has yet been effected of the strike of the linemen of the White-Crosby Company. The workmen boast that the company must grant their demands or otherwise they will not have the transmission line completed by the 15th of November, as their contract demands. On the other hand, the White-Crosby Company claim it can secure plenty of other practical men. The men assert that under their present pay, which is $2.50 per day, with loss of time in case of rain, they cannot average over $10 per week. They say that their petition for $3 per day was treated with contempt, and they were told if they didn't like the work they could go to the office and get their pay and quit. The old men who have been at work are now laid off, and they assert that all the linemen in the different unions will go out unless the White-Crosby Company, which is building the line, comes to terms. Supt. Wilson, of the White-Crosby Company, said that material for further work on the line is not here now, and the men are not needed. He further states that out of the 20 linemen at work, but three or four belong to the union, and no great trouble is expected when the company gets ready to put on more men again.

PROGRESS ON THE NEW POWER PLANT.—Last week there was a busy scene down in the massive power house of the Niagara Falls Hydraulic

Power & Manufacturing Company in the gorge. The turbines and dynamos were in place and the dynamos had begun to whirl. The first dynamo was run slowly at first, at about 50 revolutions per minute. This dynamo has a capacity of 280 volts, 2000 amperes and runs at 250 revolutions per minute. There are five more dynamos just like it in the building, two of which have a capacity of 550 volts, one 125 amperes and running at 300 revolutions per minute. Other dynamos were started later in the day. There will be eight dynamos in all, and for these there are four turbines. The machinery is not yet out of the hands of the builders, James Leffel & Co., of Springfield, O. This firm conducted the tests. When the power company accepts the plant, other tests will be made and if everything is all right, the company will commence at once to deliver power to the Pittsburg Reduction Company, whose big plant on top of the bank will be ready to run as soon as the power company has power ready for it. This will be within two or three weeks, Mr. Johnson stated. The penstock with all its appurtenances is by no means a small part of the power apparatus. It runs up 70 feet on an angle from the floor of the power house and then perpendicularly to the top of the bank. Beginning where the angle ceases the penstock will be enclosed so as to furnish a tight box 6 x 8 feet in size through which the conductors will pass along by the side of the penstock. These wires are supported every 25 feet and at the top of the penstock enter a wooden conical structure large enough for a man to stand in, and built along the penstock. The penstock here runs horizontally into the forebay under the building of the Reduction Company. Down in the power house the wires, the number of which is not yet known, will pass under the floor to the various switchboards. The company has one switchboard with a mottled marble front now in position for its own use, and it will take care of two dynamos. The Reduction Company will have various switchboards for its use which are not yet in place. Upon the floor over the forebay there is an arrangement different from that of the other power companies. The gate that controls the water flowing into the penstock will be raised and lowered by hydraulic pressure. An electric motor is in position here to supply the power, and the hydraulic cylinders, etc., are in place above the gate. The arrangement will work the gate of the waste weir on the north. More power will be required here, and 2000 horse-power can be obtained.

NIAGARA FALLS POWER CELEBRATION.—Now that Buffalo has decided to celebrate the arrival of power in the city and Tonawanda has also taken steps in the same direction, the City of Niagara Falls now expects to have a celebration. The matter of a power celebration there has been talked about for two or three years and the officials of the Cataract Construction Company have several times said that they wanted to have a celebration and would do their part in it. They have felt, it is understood, that the citizens of Niagara Falls should also take a hand in the celebration, and it looks now as if they would do so. The other great power company will also undoubtedly do its share. It was suggested that if the National Electric Light Association decides to hold its convention here next year, it would be a good thing to have the celebration at that time. President McIntyre of the Chamber of Commerce made a suggestion that Falls Street, Buffalo and Erie Avenues, constituting one thoroughfare in reality, ought to be brilliantly lighted by electricity from the park to the power-station of the Niagara Falls Power Company. He would have an iron post every 75 feet along this thoroughfare and on it a double elec lamp. The committee appointed by the Chamber of Commerce of Niagara Falls to prepare a plan or make some suggestions in regard to the proposed celebration met at the Power City Bank, and after a general discussion of the matter a formal report was prepared to be submitted to the Chamber of Commerce. The enterprising men of Niagara Falls have two great projects on which to devote their time during the next six months. The two are embraced in one general scheme. The first of these projects is a great electrical exposition that shall outstrip the one recently held in New York. The exposition that will be held here next Summer will be under the management of a committee of the Chamber of Commerce, or rather the programme for it will be arranged by this committee. At this exposition all kinds of machinery connected with electricity will be seen. The committee intends to have everything in the electrical world shown to the best advantage. There is also talk of having an electrical congress here, about which more later will be heard. Mayor Schoellkopf, W. Caryl Ely, W. B. Rankine, Augustus Thibadeau, John J. McIntyre, J. C. Morgan, W. S. Humbert, W. Johnson, W. A. Brackenridge, Max Amberg, Major Low, Assemblyman Dudley, and all the Aldermen and other city officials are interested in the projects and will carry them through to success. The men present favored a grand electrical exhibition during the forepart of June, at which there will be speeches by distinguished men and a general illumination. W. Caryl Ely and William B Rankine were added to the celebration committee. This is a final move in the celebration business, and the one in this city next June will be on a big scale. The committee in its report said: "It is the opinion of your committee that it is impossible to celebrate properly the event in a few days, but that the celebration should take the form of an exhibition to begin on June 1, 1897, and to continue for a month or six weeks. That such an exhibition requires the erection of a permanent building of sufficient dimensions to allow of a proper exhibition of the various electrical devices and modes in which electricity has been applied to the purposes of mankind. Such a building in the future could be utilized as a permanent convention hall for the City of Niagara Falls, which all must realize is one of our necessities. Your committee considers that the opening of the exhibition would be a proper occasion for a formal celebration of one or two days, at which time prominent citizens of the State and nation might be invited to attend and participate, at which time also and as far as possible during such exhibition it would be fitting to illuminate by electricity by every possible manner the principal streets of our city, the Falls, the suspension bridges, the rapids and the whirlpool." The Messrs. Schoellkopf, Ely and Rankine feel certain that the electrical exposition will materialize all right, and that Niagara Falls will, before another year, have its convention hall. The matter of illuminating the streets and Falls can easily be accomplished. Mayor Schoellkopf and W. B. Rankine will give enough electricity to do the lighting during the carnival. A grand parade is also talked of in which all the military and civic organizations as well as the school teachers and children will take part.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Oct. 23, 1896.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.—This association, which has its office at 55 Kilby Street, Boston, is sending out a circular-letter in accordance with its custom, asking for suggestions in relation to electric light rules to be considered at the annual meeting of the Electrical Committee which will be held in New York on Dec. 8 next.

A FINE ISSUE.—The September issue of the *Standard*, which is a weekly insurance paper published in Boston, is a work of art. It contains many articles of deep interest to insurance men, and among these is one by Mr. C. M. Goddard, secretary of the Underwriters' National Electric Association, on the subject of the "Electrical Hazard." This fine issue is published in magazine form and is provided with a cover of artistic design and execution.

MR. GEORGE A. REYNOLDS, cashier of the Pratt & Whitney Company, Hartford, and connected with the company for over 17 years, was the recipient last Friday evening, Oct. 23, of a testimonial banquet at the Hotel Hartford, in celebration of the 50th anniversary of his birth. It was tendered by the officers and heads of departments of the company and his associates in its employ. Mr. Reynolds was also presented with a handsome reclining chair. The occasion was thoroughly enjoyable, and will undoubtedly ever figure in his after life as one of his most pleasant reminiscences. The esteem in which Mr. Reynolds is held by the citizens of Hartford generally is as marked as that of his company and associates. He is prominent in Masonry and especially in a large number of fraternal organizations.

THE PERKINS ELECTRIC SWITCH MANUFACTURING COMPANY, of Hartford, Conn., has perfected an enclosed arc lamp that has been tested in Boston, New York, Cincinnati, Chicago and other cities and which is pronounced to be very satisfactory in every way. The Perkins Company has also placed on the market a new solid plate flush switch which is made in such a way that the plate is adjustable to any irregularity in the surface of the wall where the switch is used. With this improved arrangement it is impossible for the handle of the switch to bind on the plate and the free working of the switch is always assured by this new invention, which will be of interest to all construction men and the trade in general. Mr. John Tregoning, an old-timer in the electrical business from the early Weston days, has recently been appointed general superintendent of the Perkins Company.

THE TRANSLUCENT FIBRE COMPANY, Quincy, Mass., is gaining quite a foothold in the electrical field. This fabric is claimed to be the only flexible and unbreakable substitute for glass on the market, and has commanded quicker recognition because of the introduction of iron and steel into the construction of buildings, greatly aggravating the shortcomings of glass skylights. The fabric is perfectly flexible and has considerable elasticity, and for this reason changes in the frame work of roofs, due to expansion, contraction, vibrations, etc., will not affect it. Another advantage is freedom from the danger of leaks. It also affords a soft and very pleasant light, free from any glare. Mr. E. H. Angier, brother of Mr. Geo. M. Angier, of the Eddy Electric Company, is the manager of this company. Mr. Angier has sold to the General Electric Company over 17,000 feet of this fabric for its buildings, and it is giving perfect satisfaction. Mr. Angier has also just received an order for 4000 feet from the Knoxville (Tenn.) Electric Railway Company, for the skylights of its power-station.

THE MANHATTAN ARC LAMP.—The extensive introduction of the Welsbach gas burners has had the effect, it is stated, of displacing a large number of incandescent electric lamps in various parts of the country, rendering it necessary for electric light companies to devise some means of preventing further loss of business and reclaiming what had been taken from them. The Edison Electric Illuminating Company, of Boston, has taken hold of the the matter in a businesslike manner and is now extensively advertising in the Boston papers the fact that it has electric current for sale, thus departing from the conservative policy hitherto pursued by such companies. The Boston company is attacking the common enemy by using Manhattan arc lamps on its circuits and in this way enabling it to give its customers a greater and more satisfactory illumination than can be secured by Welsbach burners and at a much smaller cost. These lamps are installed free of charge. Other companies who have the same foe to contend with might profit by the adoption of the Boston company's plan.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, ILL., Oct. 23, 1896.

STRIKE.—On Oct. 22 a strike of the employees in the molding department of the American Carbon Company, Noblesville, Ind., was precipitated. The trouble was satisfactorily adjusted within 24 hours, however, and the business is running now as smoothly as ever.

MR. EDWIN S. CRAMP, superintending engineer for Messrs. Cramp & Sons, Philadelphia, visited Chicago last week, to see the performances of one of their latest engines for street railway work, which has recently been installed in the power house of the South Chicago City Railway Company. It is claimed that this is one of the most economical engines that has yet been produced for street railway work.

MESSRS. CARLISLE & FINCH, Cincinnati, O., report a rapidly growing demand for their novel electric railways. These are complete working models and are operated by a small battery which it is stated will run the car a distance of nine miles on one charge of solution. These novelties are great favorites with electrical supply dealers. Messrs. Carlisle & Finch also manufacture searchlights, focusing lamps and electrical novelties.

PROTECTIVE ASSOCIATION.—The Electrical Manufacturers' & Dealers' Protective Agency Company has been incorporated in Cleveland, and at the first stockholders' meeting, held a few days ago, the following named gentlemen were elected officers for the ensuing year: James L. Mauldin, presi-

dent; G. D. Hile, vice-president; C. S. Horner, secretary and treasurer. The Board of Directors includes T. W. Hill, F. L. Homer, A. B. Foster, F. W. Bunts, B. F. Horner, A. A. Pifer and the officers of the company.

THE SUNBEAM INCANDESCENT LAMP COMPANY has arranged to sell its entire output of lamps through the Western Electric Company, Chicago. The Sunbeam Company will still keep its identity and the business will be done in its name, but its sales department will be removed to the Western Electric Company's building, and it will have the benefit of the Western Electric Company's unequalled selling organization. The Sunbeam Company has recently equipped an entirely new factory at Desplaines, Ill., just outside of Chicago limits, and it has added in every department the most modern machinery and apparatus used in lamp manufacturing. Although the factory has been largely increased, it has already been found necessary to run it at its full capacity, so as to keep up with the large number of orders that are being received.

PACIFIC COAST NOTES.

SAN FRANCISCO, CAL., Oct. 11, 1896.

MR. A. E. BROOKE RIDLEY, of this city, has been appointed general manager for this section of the Electric Storage Battery Company. His headquarters are at the agency of the Siemens & Halske Electric Company, 10 Front Street.

THE SPERRY FLOUR COMPANY is now operating successfully its mill at Fresno, Cal., with electricity supplied by the San Joaquin Electric Company. A General Electric three-phase synchronous motor of 150-kw capacity at 1040 volts is used.

ELECTRIC ELEVATORS.—John Hammond, local agent of the Sprague Electric Elevator Company, New York, is installing in the store occupied by O'Connor & Maffitt, on Post Street, a single-drum, tandem-worm passenger elevator with a guaranteed capacity of 4000 pounds.

THE PACIFIC POWER COMPANY, of this city, has closed a contract with the Abner Doble Company for a Walker generator of 300-kw capacity, which will be direct-connected to a 500-hp Willans engine. The new installation is required for the extension of the company's power circuits.

THE FRASER ELECTRIC ELEVATOR COMPANY, of this city, is building two elevators for the new Hobart Building on Post Street, which six stories in height. One of the elevators is to be for freight. Four-pole motors of a special type will be employed. A capacity of 1500 pounds lifting 500 feet a minute will be required. The manufactory is at 122 Main Street.

THE RYDER ELECTRO-COMPRESSED-AIR MOTOR COMPANY, of this city, will soon have its system in operation on the cars of the Central University & Ferries car line of Berkeley, Cal. The cars fitted with the Ryder motors will be operated without the use of wires or conduits. It is said that the street railway lines of Santa Rosa, Cal., will be consolidated and operated by the same system of motors.

THE RIVERSIDE, CAL., transmission circuit, for the Riverside municipal electric plant, taking its current from the power-house at Redlands, is completed. The line construction work was done by the California Electrical Works, of this city, under the supervision of Manager Greenwood. The poles are 30 feet long and set 120 feet apart. No. 3 and No. 4 B. & S. gauge wire is used. The length of the line is 20 miles.

THE LOS ANGELES CONSOLIDATED STREET RAILWAY is being successfully operated from its new power plant. The new installation was under the supervision of Messrs. Hasson & Hunt, consulting and electrical engineers of this city. The work has been thoroughly tested and it is very creditable to all concerned. The work of reconstruction has been going on since the month of May. An 800-kw Walker generator is driven by a 1200-hp Allis engine, operating nearly 100 cars.

THE STANLEY ELECTRIC MANUFACTURING COMPANY, through its San Francisco agency, has secured the contract for an electrical transmission plant for the Blue Lakes Water Company of this State. Included in the contract are three 450-kw alternating generators. Two circuits are contemplated, one extending through a mining district in Calaveras County. One of the circuits will be 26 miles in length. The California Exploration Company expects to buy power from the Blue Lakes Company for its great mining operations. Sidney Sprout, of this city, acted as consulting engineer in the preliminary work, resulting in the letting of the above contract.

THE SIEMENS & HALSKE ELECTRIC COMPANY, through its local agency, recently closed a contract with the Pacific Mail Steamship Company for electric light installations for three steamers. The contract calls for three direct-connected generators each of 15-kw capacity. The Union Iron Works Company, which holds the local agency for the Siemens & Halske Company, is installing in the Eleventh Street electric power station of the Market Street Railway Company three combined engines and dynamos. Each of the triple-expansion vertical engines is directly connected to two 400-kw Siemens & Halske generators. One combined engine and generator of the same type has been in successful operation in the station for several months. The engines were manufactured at the Union Iron Works in this city.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, through its local agents, recently sold to the Central California Electric Company, of Sacramento, two 60-light Westinghouse direct-current arc light generators, each directly connected on the same bed-plate with a Tesla motor. The speed is 900 revolutions a minute. A contract has been closed with the Central California Company for a Westinghouse two-phase transmission plant, capacity 1500 horse-power. Current will be transmitted 30 miles from New Castle to Sacramento at 15,000 volts. Water-power will be obtained from the South Yuba ditches. The Westinghouse Company is installing central stations for lighting purposes at Downieville, Cal. and Paso Robles, Cal., the capacity of each being 45 kilowatts. The agency has sold 50,000 Sawyer-Man lamps in two weeks past.

CANADIAN NOTES.

MONTREAL CAN., Oct. 22, 1896.

PARIS, ONT.—It is probable that an electric railway will be built from this place to Brantford.

AYLMER, QUE.—The Hull Electric Railway has bought ground for a new park just outside of Aylmer.

PARRSBORO, N. S.—Dr. J. R. Smith has secured from the town a franchise to operate an electric light plant.

DUNDALK, ONT.—The town authorities are now discussing the advisability of lighting their town by electricity.

NANAIMO, B. C.—The Town Council has passed a by-law authorizing the expenditure of $3000 for an electric fire alarm system.

PETERBOROUGH, ONT.—Mr. J. M. Campbell, electrician of Kingston, is preparing plans for the electric station and plant at Peterborough.

HAMILTON, ONT.—The Hamilton & Radial Railway Company intends to extend its line from the power house to Port Nelson, and next Spring it will extend to Oakville.

ST. JEROME, QUE.—The St. Jerome Power & Light Company is being incorporated with a capital stock of $50,000, to take over the electric plant now operated at St. Jerome, together with the water-power and mill privileges. Head office at Montreal.

LIVERPOOL, N. S.—An electric railway is to be built at once from this place to the pulp mill at Milton, to carry its products, as well as passengers, to the seaport. In the mean time, until a suitable electric plant can be obtained, the cars will be run by steam.

QUEBEC, QUE.—The Quebec, Montmorency & Charlevoix Railway Company has transferred its rights in the electric railway to the new company. Two hundred men will be put on the lower town section to St. Sauvens next week. In connection with the construction of the electric railway it is probable that a bridge will be built over the St. Charles River to Parent Park.

NIAGARA FALLS, ONT.—The Niagara Falls Park & River Electric Railway will, it is said, be extended from Chippewa to Fort Erie, and from Queenston to Niagara-on-the-Lake. The company may also develop and sell power. It is thought that the road, if operated more nearly in connection with the Gorge Railway on the United States shore, would be a profitable investment for its shareholders, which it has not hitherto been.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, Oct. 16, 1896.

ELECTRICAL ENGINEERING EXHIBITION.—The ancient City of Newcastle proposes to celebrate the sixtieth year of the Queen's reign by holding an exhibition, the main object of which will be to bring out the progress made in electrical engineering between the years 1837 and 1897.

ELECTROLYTIC PRODUCTION OF POTASSIUM PERCARBONATE.—A somewhat startling announcement has just been made by MM. E. J. Cousin and A. von Hausen, of the Zurich Polytechnic, to the effect that they had succeeded in electrolytically preparing a new salt of high theoretical interest, viz., potassium percarbonate $K_2C_2O_6$. It appears that the possibility of the existence presented itself from a consideration of the probable result of the dissociation into its ions of an alcohol carbonate when dissolved in water.

CO-OPERATIVE HOUSE WIRING.—The good people of Leyton, a suburb of London, will shortly be enjoying the benefits of municipal electric lighting. The shopkeepers of Leyton do business in a small way, and there was some danger, at the time of the inception of the scheme, that owing to the expense of the wiring the majority of the customers reckoned upon by the local authority would be unable to take current; hence there would be a municipal station without customers. A brilliant idea, however, has presented itself to the Leyton Tradesmen's Association. It is proposed that the wiring of the shops and houses of all members of this association should be combined into one big job and let to a big contractor, so that the cost to each individual will be at the same rate as if he were installing a much larger number of lights.

THE UNDERGROUND RAILWAY AND ELECTRIC TRACTION.—The following is an extract from a circular just issued by the secretary of the Metropolitan District Railway Shareholders' Association to the shareholders of the Metropolitan District Railway Company: "In order to correct the many misstatements being made in connection with a projected deep level express railway from Earl's Court to Mansion House on the existing lines of the Metropolitan District Railway, I am instructed to make known the following particulars of the scheme, and the progress made to date. (1.) The scheme which has been unanimously approved by the directors of the Metropolitan District Railway is for the construction of two deep-level tunnels for up and down service of express electric trains between Earl's Court and the Mansion House, with an intermediate station at Charing Cross. (2.) Sir Benjamin Baker, the engineer to the company, foreseeing no unusual difficulties, acting upon the instructions of the association and the company, is now preparing a survey and report on the lines in projection. (3.) The survey and report are expected to be completed, and a bill prepared for Parliament by Nov. 15 next." I may say that the line is expected to cost one million sterling.

ELECTRICITY IN THE NAVY.—Much interest is evinced in naval and mechanical engineering circles in the trials of H. M. S. *Powerful*, which, together with her sister ship, the *Terrible*, are the two largest and fastest cruisers afloat, having a displacement of 14,000 tons and a length over all of 538 feet and a beam of 71 feet. The electrical equipment of these vessels is very complete. They are electrically lighted throughout by three direct-coupled dynamos giving 80 volts and 600 amperes at 300 revolutions. The lighting of the ship is carried out by means of 800 50 and 16-cp lamps, the double wire system being used throughout. Mastheads, military tops, semaphores, telegraphs, compasses, side lights and signal lanterns are all separately lighted and under

control from the deck. Six searchlights are provided, two on the forwafd and two on the after bridge, and one on the top of each mast. Electric motors are used throughout, not only for training and elevating the large guns (22 ton breech loading) but also for the ammunition hoists. The submarine torpedoes will, of course, be fired by electricity from the directing house on the conning tower. Although, of course, there is a complete system of blowing fresh and exhausting foul air, electricity is not made use of in this connection.

General News.

NEW INCORPORATIONS.

THE VALLEY ELECTRIC HEAT & POWER COMPANY, Beaver Falls, Pa., has been organized by H. W. Reeves, W. A. McCord, L M. Eckert and S. B. Reeves.

THE CLEVELAND, BEREA & ELYRIA RAILWAY COMPANY, Berea, O., has been formed by A. H. Pomeroy, L. M. Cove, and A. R. Atkins. Capital stock, $800,000.

THE PURITAN ELECTRIC COMPANY, New York, N. Y., has been formed by F. P. Delafield, B. A. Gould, Jr., and C. L. Schurz, New York City. Capital stock, $75,000.

THE WHITE COUNTY TELEPHONE COMPANY, Carmi, Ill., has been incorporated with a capital stock of $2500. The incorporators are John M. Crebs, Bradford Powell and John G. Powell.

THE EAST PENN TRACTION COMPANY, New York, N. Y., has been incorporated by Robert E. Pleeve, New York; S. Edwin Long, Philadelphia, and Walter Brown, Philadelphia. Capital stock, $350,000.

THE PHŒNIX LIGHT, HEAT & POWER COMPANY has been incorporated in St. Louis, Mo., with a capital stock of $20,000. The incorporators are James Campbell, Isaac H. Lionberger and Alexander Ross.

THE ARC-WELDING COMPANY, Detroit, Mich., has been incorporated with a capital stock of $350,000. The incorporators are Charles L. Coffin, Detroit, Mich.; John W. Welch, Hartford, Conn., and B. H. Haigh, Brooklyn, N. Y.

THE HAMILTON & MIDDLETOWN TRACTION COMPANY, Hamilton, O., has been incorporated with a capital stock of $10,000. The incorporators are O. B. Brown, William A. Mays, Dennis D. Dwyer, Albert Emanuel and Thomas A. Legler.

THE WHEELING PRIVATE ELECTRIC CORPORATION has been organized in Wheeling, West Va., for the purpose of making and dealing in electrical instruments, machines and supplies. The incorporators are H. S. Sands, L. E. Sands, H. E. Hohman, T. H. P. Kyser, Wheeling, West Va. Capital stock, minimum $500; maximum $25,000.

THE BATCHELOR ELECTRIC COMPANY, New York, N. Y., has been incorporated in West Virginia for the purpose of obtaining, owning and selling patent rights of the United States and foreign countries upon useful inventions. The incorporators are: Joseph F. Batchelor, Brooklyn; Charles J. Pearson, New York and George A. Stearns, Long Island. Capital stock, minimum $500; maximum, $100,000.

TELEGRAPH AND TELEPHONE.

NEWARK, O.—It is stated that the Newark Telephone Company will extend its line to several towns and villages in Licking County. These improvements will be of great benefit to this section, and are very desirable.

HOLLY, MICH.—It is stated that another telephone line will be built between this place and Fenton. The object of this move is stated to be to effect a reduction in rates, the present company charging what is regarded as excessive prices for its service.

RUSSELLVILLE, KY.—The Cumberland Telephone & Telegraph Company, which has been doing business in this place, has been sold to the East Tennessee Telephone Company. It is stated that there is not enough business for two telephone services in this locality.

VOSBURG, FLA.—The contract will soon be let to the lowest bidder for the building of a telephone line from Hattiesburg to Meridian, a distance of about 100 miles. The enterprise is promoted by business men along the line of the New Orleans & Northeastern Railway.

LOUISVILLE, KY.—The Keutz National Telephone Company has petitioned the City Council for a franchise to establish an exchange in this city. The company is now operating its system in Jeffersonville, Ind., and if it obtains the desired permission to do business in this city it promises to greatly reduce the rates on telephone service.

KINGSTON, N. Y.—The Deep Notch Telephone Company will build telephone lines throughout the Catskill Mountains in both Ulster and Greene Counties. The company has just been organized with the following officers: Frank Smith, of New York, president; John D. Newton, of New York, vice-president; Charles Tappen, of Kingston, secretary and treasurer.

SAN JOSE, CAL.—The People's Telephone Company, of this city, has been attached in a suit brought by the Washburn & Moen Manufacturing Company. The amount of the claims aggregate $18,908. Charles Severance has been appointed receiver, and there is a probability that the company will be reorganized. It is stated that the suit is a friendly one, and is brought for the purpose of effecting a reorganization.

WASHINGTON, D. C.—By the order of Mr. Frank Jones, First Assistant Postmaster-General, all the telephones in the Washington Post Office and its various branches were removed on Oct. 10. The order was the result of an ineffectual endeavor to secure lower rates from the telephone company. The Post Office has been paying from $80 to $120 per year for the use of the instruments, and in view of alleged cut rates to other patrons, a demand was made by the Post Office authorities for a reduction. Mr. Jones offered an ultimatum of $50 a year. The company said it could not furnish the instruments at this figure without loss, hence the order to cut the instruments out. The matter will be referred to Congress for further action.

ELECTRIC LIGHT AND POWER.

FALLS CITY, NEB.—The citizens have voted to issue bonds for the purpose of improving and extending the electric light system.

GRAND RAPIDS, MICH.—The Furniture City Electric Company has secured the contract for wiring the Clark Building of that city. The building will be wired for 2000 lights.

RICHMOND, VA.—Messrs. Thomas & Hunter have been awarded the contract for drawing the plans and specifications for a municipal electric lighting plant for the town of Washington, N. C., and will in a short time be ready for bids.

NEW YORK.—The Richmond County Electric Light Company, of St. George, S. I., has applied for a franchise, agreeing to pay 1 per cent. of its gross earnings from the village business during the first five years, and 3 per cent thereafter.

GLADSTONE, MICH.—The plant of the Gladstone Electric Light Company was recently destroyed by fire. As the company's contract with the city expires in a short time it is doubtful if the plant will be rebuilt unless a new contract can be effected.

CINCINNATI, O.—It is reported that the Edison Electric Light Company of this city will in the near future erect a new and more commodious plant than the present one. The facilities of the company are taxed to their utmost and more room is necessary. The present building on Eighth Street will be turned into an office and store building on the completion of the new plant.

CICERO, ILL.—G. M. Davis, president of the Cicero Heat, Light & Power Company, has made a proposition to the Cicero Town Board to lease to the town the entire arc plant of the company for a period of 15 years with the option of purchase by the town at the end of that time. The proposed plan is that the town shall undertake to do its own street lighting, thus offering an opportunity to try the experiment without the investment of money.

SCRANTON, PA.—Judge Gunster on Oct. 19 handed down an opinion in which he declares invalid $15,000 of borough bonds issued to increase the electric light plant of the borough. This increase was authorized on Jan. 5, 1895, by the City Council, on the ground that the then existing plant was inadequate. In June last the Council advertised for bids for the extension of the plant and undertook to enter into contracts with different parties for the purpose of carrying out the plans. Judge Gunster states that at the time the contracts were awarded and entered into no bonds had been issued and there was no money in the treasury and that the consent of the electors had never been obtained to an increase of indebtedness except by the issue of bonds and that it necessarily follows that the contracts mentioned were not only not authorized by law, but were a violation of the law. He therefore declared that the contracts awarded under the resolutions should be declared illegal and the defendants restrained from carrying out the same.

THE ELECTRIC RAILWAY.

YOUNGSTOWN, O.—The City Council requires that fenders be placed on all of the street cars.

PLAINFIELD, N. J.—The extension of the trolley system from this place to Scotch Plains is again being agitated.

ROCHESTER, N. Y.—There is talk of building a trolley road between Rochester and Fairport. It will be used for passengers and freight.

BRISTOL, PA.—The Bristol & Langhorne Trolley Company will extend its lines through Newportville, Emilie and Fallsington to Trenton, N. J.

BRUNSWICK, ME.—It is rumored that the Brunswick Electric Railway Company intends to build a road and run its cars from Brunswick to South Harpswell next Summer.

LYNBROOK, L. I., N. Y.—The officials of the Long Island Railway have been looking over the Long Beach Railway with the idea of substituting electricity for steam as the motive power.

BANGOR, ME.—A hearing will be held on the application of the Bangor Street Railway Company for permission to extend its Main Street line from its present terminus southward to the Hampden line.

PITTSBURG, PA.—The Millvale & Etna Street Railway Company has been granted permission by the Millvale authorities to double track its line through that borough and for an extension of the line to Bauerstown.

MALDEN, MASS.—At a meeting of the Malden City Council the Lynn & Boston Street Railway Company was granted a location in the centre of Florence Street, the track to run close to the Boston & Maine depot.

PITTSBURG, PA.—It is reported that the Thomson-Houston Electric Company has filed a suit in the United States Circuit Court against the Johnstown Steel Company and Steel Motor Company on the ground of alleged infringement of a trolley patent.

SPRINGFIELD, MASS.—A company is being formed to connect Springfield, Mass., with Suffield, Conn., by an electric line, a distance of 10 miles, over a new bridge to be built across the Connecticut River. The capital stock of the company will be $500,000

NORTH HAVEN, CONN.—Residents of North Haven are anxious to have a trolley line run to this city, and have asked the Fairhaven & Westville Company to extend the Montowese line. It is likely that the railway company will petition the Legislature for the right.

SPRINGFIELD, MASS.—The promoters of the Springfield, Agawam & Suffield Electric Railway propose, if the necessary permission can be secured, to build a line from Main Street, in this city, across the toll bridge, through West Springfield and Agawam to Suffield.

STEELTON, PA.—Consent is given to the Citizens' Passenger Railway Company and the Harrisburg Traction Company, operating the same, to extend and construct its line of railway and erect the necessary poles, wires, etc., on various streets of the borough.

WOBURN, MASS.—It is reported that in the near future a power plant for the electric street railways running into this city will be erected here. The North Woburn line is unable to get sufficient power and make schedule time when the full number of cars are in use.

BUCYRUS, O.—The Commissioners of Crawford County granted William Haycox of Mansfield, and Fred Perkins of Toledo, a franchise or right of way between this city and Galion for an electric railway. The road is to be in operation before December of next year.

RICHMOND, VA.—A franchise has been granted to the Lee District Street Railway Company to run a line from Broad to Main Streets and return. The proposed route is by way of Allison Street and Park Avenue and the new railway will be independent of either of the old companies.

TAMPA, FLA.—The new electric railway from this city to the new dam and power station of the Consumers Electric Light & Street Railway Company, which is located six miles up the river, has just been thrown open to the public. This is said to be one of the largest enterprises in the South.

DOYLESTOWN, PA.—A syndicate of Philadelphia capitalists, headed by George S. Gandy, has obtained a controlling interest in the stock of the Bucks County Railway Company, and with the necessary franchises secured will construct the long-talked of electric road from Willow Grove to Doylestown.

BRADFORD, PA.—A trolley line is to be built from Bradford to the Lewis Run in the near future. The road is to start at the city limits and take in the towns of Toad Hollow, De Golia, Custer City and Lewis Run on its route. Among the projectors are Hon. Lewis Emery, Jr., W. H. Weaver and others.

QUAKERSTOWN, PA.—At a special meeting of the Town Council an ordinance was passed granting to the Quakerstown Traction Company the right of way through this town. It is thought that the line will be carried to Richlandtown and possibly to Trumbauersville. Mr. C. T. Leland is interested in the project.

CINCINNATI, O.—The citizens of Home City and Delhi are anxious to secure rapid transit accommodations, and a citizens' committee has been appointed to agitate the extension of the Riverside electric line to the villages. It would require about four miles of track to reach these villages, taking in Holabird, Trautman's, St. Joseph and Crescent.

PHILADELPHIA, PA.—At the meeting of the Street Railway Committee of the Councils it was decided to report to Councils with a favorable recommendation the ordinance granting permission to the Holmesburg, Tacony & Frankford Electric Railway to lay double tracks on Unrug Street, from the Delaware River to the Bristol Turnpike.

HATBORO, PA.—Representatives of the Doylestown-Willow Grove Trolley Company were in Hatboro with a scheme for building a branch to connect their line and the borough. It is proposed that the spur shall leave the main line at Joshua Cope's and cross the farms at Cope, Hause and Clotworthy, coming out on the York Pike within the borough limits.

NEW HAVEN, CONN.—Under the general street railway law of this State the New Haven & Derby Electric Railway Company has brought suit in the Superior Court to determine the public necessity and convenience of a trolley road between Derby and New Haven, which if constructed will be a close parallel to the New Haven steam railway between the cities named.

MADISON, WIS.—Arrangements have been made to extend the street car line *via* University Heights to Wingra Park and thence to the cemetery. The cost will be about $13,000, to be paid by the property owners. The Street Car Company has made a five-year contract for power from the Madison Gas & Electric Company, and will not put in a plant of its own as contemplated.

CHESTER, PA.—The directors of the Philadelphia & Westchester electric railway are anxious to extend their tracks from Newtown Square to Castle Rock, where it is proposed to establish a park. The owner of a certain piece of property, however, will not grant them the right of way, and it is stated that the Pennsylvania Railroad Company is backing this person in his objections.

TARRYTOWN, N. Y.—Arrangements are now being proposed to secure the acceptance of a franchise by the New York, Elmsford & White Plains trolley road to run their cars from Elmsford to Tarrytown, thus connecting the county seat, White Plains, with the Hudson River town. The company has signified a willingness to comply with the requirements of the Tarrytown authorities.

MILFORD, MASS.—The Medway Selectmen have voted to grant but one electric street railway franchise and that to the Milford, Holliston & Framingham Street Railway Company. The route granted was the original line requested by this company in its petition of Aug. 14. The company will be required to furnish bonds to have the road in operation within a reasonable time. It is probable that the line will be built this Fall.

BALTIMORE, MD.—The Druid Hill Avenue Line of the Baltimore Traction Company, which has been equipped on the overhead trolley system, is now in operation. This was the first rapid transit route to be built in this city, and was on the cable system. Electricity displaces the cable in the improvement, and several new cars have been placed upon the line. A portion of the power is taken from the Belt Line power-house at Camden station.

NEW HAVEN, CONN.—In the Superior Court of Hartford County Judge Wheeler has rendered a preliminary decision on a demurrer in favor of the New England Railroad Company in its suit against the New Britain, Newing & Hartford Electric Railway Companies. This case has long been in litigation and involves a parallel trolley line with the steam roads between New Britain and Hartford. The case will now be tried on its merits.

HARRISBURG, PA.—In the case of the Cumberland Valley Railway Company *vs.* the Harrisburg & Mechanicsburg Electric Railway Company, *et al.*, Justice Sterrett has rendered an opinion reversing the decree of the lower court, and grants a perpetual injunction against the latter company. The question involved was whether a company chartered under the street railway act of 1889 has the right to construct its road across the lines of a steam railway company without the consent and against the protest of the latter at a point where its roadway is not crossed by a public highway.

Personal Notes.

MR. HENRY MULLER, JR., has been appointed New York representative of the Phœnix Carbon Company, of St. Louis, with office at 136 Liberty Street.

WE LEARN that Mr. Emil Kolben, who formerly was in this country and has many friends here, has resigned his position with the Oerlikon Company, in Switzerland.

MR. THOS. J. FAY, for a number of years the New York representative and late general manager of the C. & C. Electric Company, has severed his connection with that company and is about to join the ranks of consulting electrical engineers.

MR. WILLIAM C. REDFIELD, treasurer of J. H. Williams & Co., the well-known manufacturers of drop forgings, Brooklyn, N. Y., is a candidate for Congress in the Second Congressional District, which comprises seven of the wards in Brooklyn. Mr. Redfield is running on the National Democratic platform.

Trade and Industrial Notes.

BENTON HARBOR, MICH.—A new company is to be formed in which George E. Davis will be stockholder, for the manufacture of dynamos and engines.

A HANDSOME PICTURE.—We have received from the Sessions Foundry Company, Bristol, Conn., a beautifully framed water color *fac-simile* picture of the company's works. The picture is a work of art, and will form a pleasing ornament on the walls of any office.

RANKIN & FRITSCH FOUNDRY & MACHINE COMPANY, St. Louis, Mo., has just issued a new catalogue of Corliss engines manufactured by this concern for both standard and heavy duty. The catalogue describes and illustrates the engines in considerable detail and gives at the end a long list of users of these machines.

J. E. RHOADS & SON, 239 Market Street, Philadelphia, report a revival of demand for leather belting. They have since Oct. 11 booked orders for 50,000 feet of their "Tannate" bell cord for street cars, for an extra heavy, three-ply, 36-inch driving belt for equipping two factories in the South and for electric belts of their "Volta Dynamo" brand.

DOUBLE GALVANIZED IRON WIRE.—John A. Roebling's Sons & Co., Trenton, N. J., are now offering to the trade galvanized iron wire which is covered with a double coating of zinc, affording an absolute protection against rust. It is claimed that this double galvanized iron wire will last three times longer than the ordinary galvanized iron wire.

REPLOGLE GOVERNOR.—In a paragraph in our last issue regarding the Replogle governor, which is made by the Replogle Governor Works, Akron, O., reference was made to the "wheel." Since this company does not manufacture water wheels, but only governors for the same, this fact should be explained. The use of the word wheel in this connection was an error and is misleading.

ELECTRA CARBONS.—Electra high grade Nuernberg carbons, as carried in stock in Chicago by the Electric Appliance Company, are rapidly extending in use in the West, and are finding favor with the trade on account of the brilliancy and steadiness of their light, and the fact that they burn almost without dust. The demand for them at this time promises a heavy Fall and Winter trade.

SCHIFF, JORDAN & CO., manufacturers of carbons, are very much gratified with the number of orders they have received since the recent establishment of a business office in New York. Some of these orders are very large and come from leading concerns. The testimonials received daily from customers who have tried these carbons speak in the highest terms possible concerning the quality of the same.

ELECTRIC APPLIANCE COMPANY, Chicago, is laying its plans to enable it to supply its customers without delay during the last three months of the calendar year. For this purpose it is increasing its stock of supplies up to a point which it believes will carry it through the season's rush and enable the company to fill promptly every possible regular order from Chicago. The trade, no doubt, will appreciate these efforts.

THE K. & W. COMPANY, Pittsfield, Mass., informs us that it has bought the manufacturing rights and the manufactured stock of the S. K. C. Specialty Company from the assignee of that company, and that it is now in a position to fill orders for all the apparatus which the S. K. C. Specialty Company manufactured. These manufactures include brushes, commutator compound, arc light cut-outs, hanger boards, switches, etc.

WESTINGHOUSE ENGINE FOR FRANCE.—An order which the Westinghouse Machine Company recently received through its Paris branch for a 1200-hp engine, similar to those exhibited by that company at the World's Fair, would seem to indicate that some features of the great Exposition made substantial and lasting impressions on our foreign visitors. The engine is to be used in an electric lighting station in France.

THE ST. LOUIS IRON & MACHINE WORKS, St. Louis, Mo., in a neat catalogue just issued illustrates and describes in considerable detail the "Heavy Duty" St. Louis Corliss engine manufactured by this concern. The

"Heavy Duty" engine is claimed to meet all the requirements for constant operation, and combines great strength, constant regulation under variable loads, economy of operation and ability to operate continuously on enormous overload.

CAR LIGHTING.—The National Electric Car Lighting Company, 30 Broad Street, New York, has issued a folder illustrating and describing the Moscowitz system of electric car lighting. which is controlled by that company. By this system the dynamo is driven by power derived from the car axle, and the use of storage batteries enables the lighting to be continued when the car is stopped. It is stated that this system requires practically no attention save an occasional inspection and oiling.

R. SCHEFBAUER & CO., 113-115 Adams Street, Hoboken, N. J., manufacturers of electrical apparatus and instruments, are making a specialty of model and experimental work. Their shop is equipped with the latest improved machinery, and they make a specialty of switches and switchboards for isolated plants, electric light and electric railway stations, and manufacture a large line of general supplies. The also repair, test and calibrate lamps, volt and ammeters, motors, dynamos, etc.

STEAM HEATING.—Warren Webster & Co., Camden, N. J., exhaust-steam specialists, have issued a catalogue describing and illustrating the Webster system of steam-heating, which has been installed in connection with the power plant in many buildings throughout the country. This system was quite fully described in THE ELECTRICAL WORLD of Aug. 29 in connection with the article on the electric light plant in the Syndicate Building, New York City, which is heated by the Warren Webster system.

NEW WIRE.—A new insulated wire is being put on the market by the Illinois Insulated Wire Company. The insulation resistance of the covering is said to be remarkable, and as it is of the weatherproof type and therefore involves a mechanical fibre, the insulation is not only electrically but mechanically very strong, two important and desirable features. Mr. Fred H. Alden is president, and while new in the electrical trade is favorably known in Chicago. The concern producing this article is called the Illinois Insulated Wire Company and is located at Sycamore, Ill.

NEW POWER-HOUSE AND CAR BARN.—The Union Traction Company, Rutherford, N. J,, will erect a new power-house and car barn. The entire contract for this work has been let to the Berlin Iron Bridge Company, East Berlin, Conn. The buildings will be of brick with steel framework, and the plant when completed will be up to date in all respects. The roofs will be supported on steel trusses and the covering is to be corrugated iron throughout. The roof of the engine house will be lined with the Berlin company's patent anti-condensation fire-proof roof lining.

BRYAN & HUMPHREY, consulting mechanical and electrical engineers, St. Louis, have just made an investigation and report on the 2000-hp steam plant at Columbus, O., where, after making a few changes in the arrangement and operation of the same, they increased the fuel efficiency nearly 40 per cent. They also have recently finished or have in hand electrical work as follows: City of Staunton, Ill.; City of Webster Groves, Mo.; Dozier Bakery, A. Leschen & Sons Rope Company, St. Louis Iron & Machine Works, Ely-Walker Dry Goods Company, Amplified Electric Company, all of St. Louis. They also have in hand the preliminary work for some important electrical railway projects.

RECENT RUBBER WIRE CONTRACTS.—J. R. Wiley, Chicago, Western manager of the Standard Underground Cable Company, has recently secured several handsome contracts for underground electric light and telegraph cables in the vicinity of Chicago; notably, rubber insulated arc lighting and telegraph cable for the City of Chicago, and a large order for duplex rubber insulated underground cable for the West Chicago Park Commission. In addition to this, the same company has recently furnished the Detroit Edison Company with a large amount of rubber-insulated lead-covered feeder cable for underground work in Detroit. Notwithstanding the general complaint of dull times, the Standard Company is reported as securing a large portion of the underground work in its Western territory. In addition to the above it is at present turning out large quantities of telephone and telegraph cables and rubber insulated "Tip Top" and "Sterling" wires for the various telephone, telegraph and electric light companies.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, 105 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 20, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

569,618. ELECTRIC CONDUIT AND APPURTENANCES; M. Dickerson, Fort Wayne, Ind. App. filed Sept. 11, 1893. The combination with an electric conduit of conductor supports each comprising a hollow insulating sleeve having an enlarged head which abuts on the outer surface of the conduit and a body portion which fits and is sealed within an aperture in said wall, said sleeve being open at its inner end only, a slightly-yielding non-metallic tubular core inserted within said sleeve, a metallic stem sealed in the tubular core, and means for attaching the conductor to the outer end of the stem.

569,634. SYSTEM OF DISTRIBUTING ELECTRIC POWER, ETC.; W. D. Gharky, Philadelphia, Pa. App. filed July 2, 1895. In a system for the distribution of electrical power consisting of a series of distributing conductors and independent feed wires leading from a source of electrical power to each conductor, the combination of two or more distributing conductors with one or more automatic cut-outs adapted to normally connect adjacent conductors and to sever their electrical connection when there is an abnormal flow of electrical current from one conductor, and means for automatically actuating the cut-out to restore connection on the reduction of flow from said conductor, beyond a determined amount.

569,649. ELECTRIC BAND; J. E. Luce, Minneapolis, Minn. App. filed Oct. 11, 1895. An electric band comprising two bands or strips of a material which is an electric insulator, a chain of thin cells provided between said bands or strips, permanent fastenings between the cells and the bands or strips, terminal electrodes, and the edges of said bands being separated to permit the introduction of an exciting fluid between the same.

569,692. MULTIPLE FUSE CUT-OUT; G. T. Voorhees, Boston, Mass. App. filed Feb. 26, 1894. A multiple fuse cut-out, consisting of a fuse-carrier, a plurality of fuses carried thereby, a contact at one end of each fuse, an exposed contact at the other end of the fuse, a conducting-shell for the fuse-carrier, and a conductor connecting the shell with the fuses seriatim; the shell being formed with an opening, the exposed fuse-contact exposed at said opening, and the shell and carrier being movable, one in relation to the other.

569,709. SAFETY APPARATUS FOR RAILWAY CROSSINGS; G. Gibbs, Milwaukee, Wis. App. filed Dec. 13, 1893. The combination with an insulated section of a working conductor on an electrically-operated road, of a cut-out therefor, and a train-stopping device, such as a signal, derailing switch, or the like, on the intersecting road operatively connected with said cut-out, and a block traffic on the electric road when the right of way is given to the other road

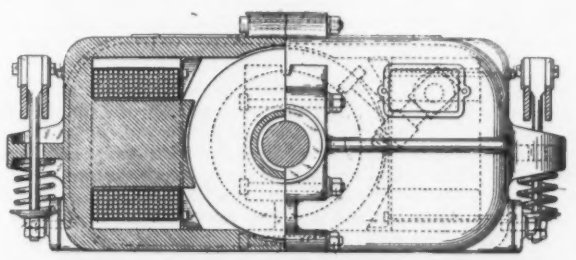
569,713. WIRE CONNECTOR; H. Haug, New Jersey. App. filed June 10, 1896. A wire connector consisting of a metal strip bent into the shape of two adjoining and connecting channels of different size, and circular in cross section, said channels being adapted to receive the wires to be jointed and to be twisted together with said inserted wires.

569,727. LOCKING ELECTRIC LAMP-SOCKET; W. L. Taylor, East Liverpool, O. App. filed Feb. 21, 1896. The combination of an electric lamp, a socket therefor, means for automatically locking the lamp in its socket by inserting the lamp therein and a key by which alone the lamp can be released.

569,738. UNDER-RUNNING TROLLEY; N. C. Bassett, Lynn, Mass. App. filed June 26, 1896. In a trolley, the combination of a support for the trolley pole, a base to which the support is pivoted, listing springs secured to the support and the base, and a spring acting to assist the lifting springs when the trolley is in the lower position.

569,746. ELECTRIC MOTOR; H. B. Collins, Fulton, N. Y. App. filed Nov. 20, 1895. In combination, a rotary pending head or part, a motor for revolving the head or part, said motor being provided with an armature and a field magnet magnetically operating to effect an upward tendency of the revolving head or part during the operation of the motor.

569,748. ARMORING OR COVERING FOR ELECTRIC CABLES; H. Edmunds, London, England. App. filed Aug. 27, 1896. Armoring or coverings for electric cables, the said armorings or coverings being made of wires of ordinary round form alternating with wires, having recesses at their sides in which the first-named wires engage.



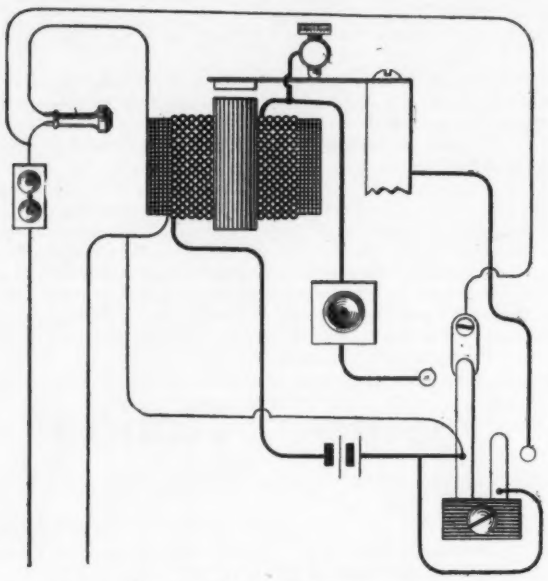
No. 569,802.—ELECTRIC MACHINE.

569,752. WIRE CONNECTOR; A. Gartner, Newark, N. J. App. filed June 10, 1896. A connector for electric wires, consisting of a metal strip bent into the shape of an oval, and having its edges overlapping and adapted to slide on each other, said oval tube being adapted to receive the wires from opposite directions and to be twisted together with said wires.

569,753. WIRE CONNECTOR; A. Gartner, Newark, N. J. App. filed June 17, 1896. A wire connector, consisting of two tubes arranged one within the other, and in close proximity to each other and adapted to receive the wires to be jointed, and to be twisted together with the said wires.

569,754. ELECTRIC LIGHTING BY WIND POWER; J. W. Gibboney, Lynn, Mass. App. filed July 23, 1896. The method of charging storage batteries from a variable source of power consisting in maintaining a strong magnetization of the field of the generator, storing the energy at the variable source of power until sufficient to start the generator at the charging potential, and regulating the application of said power to produce a volume of charging current proportionate to the amount of energy delivered at the place of storage.

569,756. TROLLEY SUPPORT FOR TROLLEY CARS; O. Holz, Schenectady, N. Y. App. filed May 2, 1896. The combination with a trolley arm which is adapted to be secured to a car, of a frame supported thereby and a spring-operated rod which passes therethrough, said rod being provided at its upper end with spring arms, and two wheels or pulleys which are mounted thereon, and which are arranged horizontally, and provided with peripheral grooves, and between which the trolley wire or conductor is adapted to pass, said spring-arms by which the wheels or pulleys are supported being each provided with a cord or other device which extends therefrom.



No. 569,807.—Telephony.

569,772. TROLLEY SUPPORT FOR ELECTRIC RAILWAYS; S. H. Short, Cleveland, O. App. filed June 8, 1896. In a trolley support for electric railways, a trolley pole, a series of springs arranged to support said pole, said springs connected at one end to a fixed support and at the other to said pole, the pole connection of certain of said springs being movable with respect to the pole connection of others of said springs.

569,785. ELECTRIC GAS LIGHTING BURNER; W. E. Cram, Boston, Mass. App. filed Jan. 29, 1896. An electric gas lighting burner having a fixed electrode, a cock, a cock-operating lever adapted to oscillate therewith and pivoted to the cock so that it can oscillate independently in a plane parallel with the axis of the cock, a movable electrode secured to the lever, and a lever-operating device having provisions, not only for oscillating the lever to turn the cock and carry the movable electrode across the fixed electrode, but also for swinging the lever on its pivot to change the path of the movable electrode after each movement of the cock, whereby said electrode is caused to make contact with the fixed electrode during one movement of the cock and to avoid the fixed electrode during the opposite movement of the cock.

569,802. ELECTRIC MACHINE; A. Schmid, Pittsburg, Pa. App. filed Nov. 27, 1891. The combination with the armature of an electric motor of a four-pole field magnet constructed in two sections, one pole and a fraction of each of two others being carried by each section.

569,803. FUSE FOR ELECTRIC CIRCUIT; C. F. Scott, Pittsburg, Pa. App. filed Dec. 3, 1895. A fuse for electric circuits, comprising a strip of metal having a comparatively high degree of conductivity and reduced in size at a point intermediate at its ends and a body of metal having a low melting point reinforcing the reduced portion of said strip.

569,807. TELEPHONY; J. T. Williams, Brooklyn, N. Y. App. filed March 25, 1895. In telephony, the combination of an induction coil, a signaling instrument, the latter being in the secondary circuit of the induction coil, a circuit shunting the secondary of the induction coil, another circuit having two branches, one of which includes a circuit interrupter and the primary of the induction coil and the other including the transmitter and the primary of the induction coil and a switch arranged to close either of said branch circuits or said shunt circuit while leaving the others open.

569,817. ELECTRIC ARC LAMP; H. P. Davis, Pittsburg, Pa. App. filed Jan. 14, 1895. In an alternating-current arc lamp, the combination of a series-coil and a coil in inductive relation thereto, of carbon-controlling mechanism comprising means actuated directly and solely by said coils to open and close the secondary circuit.

569,818. ELECTRIC ARC LAMP; H. P. Davis, Pittsburg, Pa. App. filed Jan. 14, 1895. The combination with a series-coil and a shunt coil having two sections, one of which is normally short-circuited, of a rocking frame provided at one end with a movable armature or core common to said coils, and a spring and a movement-retarding device connected with the other end of said frame.

569,824. BRUSH HOLDER FOR DYNAMOS; W. M. Hand, St. Louis, Mo. App. filed Jan. 27, 1896. In combination with a commutator brush and a holder therefor having a socket, a spring for pressing the brush and conducting the current working in said socket and formed of flat metal having its transverse dimension in the direction of yielding reduced to give the requisite resiliency, and having its other transverse dimension relatively increased to afford ample section for conductivity without heating.

569,827. SINGLE WIRE ELECTRIC RAILWAY; J. C. Henry, Westfield, N. J. App. filed Aug. 27, 1892. An overhead electric railway having two tracks and a single working conductor common to both, of a zig-zag feed and span wire, insulators supported by said feed and span wire, having hangers to support the working conductor and branch wires connecting said conductor with the feed and span wire.

569,836. ELECTRICALLY WELDED PIPE JOINT; A. H. and I. C. Matatall, Harrison, N. J App. filed Aug. 25, 1895. The process of electrically welding metallic pipes which consists in interiorly reaming out both sections of the pipe, until the inward bevel extends to the periphery of the pipe, and thereby reducing outward resistance to end pressure, subjecting the reamed-out extremities to end-to-end pressure, and at the same time to an electric current and thereby softening the extremities and turning the same outward and thus welding the parts together.

569,851. THERMOSTATIC FIRE ALARM; H. Baer, New York, N. Y. App. filed March 7, 1896. In a thermostatic fire alarm, the combination of a thermostatic bar, means for heating said bar, a detent connected with the thermostatic bar, a movable contact supported by said detent, and another contact adapted to be engaged by said movable contact whenever the heat action on the thermostatic bar is interrupted, so that an electric circuit is closed and the alarm of fire given.

569,861. CIRCUIT-CLOSER FOR BURGLAR ALARMS; C. H. Dowden, Newark, N. J. App. filed Feb. 29, 1896. An electric circuit-closer comprising two side plates, a recessed insulating block secured between said side plates, two rockable contact blocks pivoted in apertures in the side plate, and a set of independent spring devices for each contact block located in the recess of the spacing block, said spring devices being adapted to separately project the rockable contact-blocks and complete an electric circuit between the side plates when either contact plate is pressed inwardly.

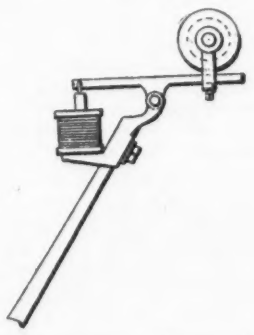
569,866. ELECTRIC MOTOR; W. E. Freeman, Long Island City, N. Y. App. filed June 4, 1895. In an electric motor, a cylindrical shell constructed of two sections with a concentrical cylindrical field magnet on the interior of the head of each of the sections, said field magnet constructed in outline eccentric to the line of the interior of the armature.

569,881. ELECTRIC ARC LAMP; J. E. Morris, Chester, Pa. App. filed April 2, 1896. In an electric arc lamp, the magnet, a core, an annular projection from the bottom of said core, a depending lug integral with said projection, a disc having a central aperture and hinged to said lug, a tubular metallic piece having a flared head located in said magnet frame above the core, standards extending from said frame connected at the top by a cross-piece having a central aperture, a carbon rod having a head formed on its upper end, brushes connected respectively on different sides of the frame and extending inwardly from the same, whereby they engage different sides of the carbon rod.

569,882. LOCK WITH ELECTRIC SAFETY ATTACHMENT; A. J. Moulart, Paris, France. App. filed June 6, 1895. In a lock, two conducting half sleeves arranged out of contact with each other, a split key-hole sleeve surrounding them, an insulating sleeve between the key-hole sleeve and the half sleeves and an electrically operated signaling device in circuit with the half sleeves.

569,889. TROLLEY FOR ELECTRIC RAILWAYS; H. A. Seymour, Washington, D. C. App. filed June 15, 1896. The combination with a trolley pole and trolley-wheel holder at the upper end of said pole, and an electromagnetic device connected with said holder and constructed to force the trolley wheel against the conductor.

569,908. TELEPHONE TRANSMITTER; H. C. Alexander, Bonham, Tex. App. filed Jan. 6, 1895. In a telephone transmitter, the combination of a diaphragm, a spring-supported carbon-cell furnished with a flange faced with soft material, and a filing of granulated electrode placed in the carbon-cell.



No. 569,889.—Trolley for Electric Railways.

569,931. SOCKET AND SWITCH FOR INCANDESCENT LAMPS; J. M. Moffat, London, Eng. App. filed Oct. 15, 1895. In an electric lamp, the combination with a cap having conducting-plates arranged for connection with the socket terminals, of two springs having their free ends separated, but in alignment with each other, one of said springs being connected with one of said plates, and the other spring being connected to one of the leading-in wires, the other leading-in wire being connected to the other plate, and a longitudinally movable rod provided intermediate its ends with an insulated conducting projection and arranged to be slit into contact with the ends of both said springs when the rod is moved in one direction and out of contact therewith when the rod is moved in the opposite direction.

569,960. AUTOMATIC CIRCUIT-BREAKER AND CLOSER; C. C. Drake, Trenton, N. J. App. filed July 10, 1896. In a cut-out, a motor provided with a movable arm adapted when released to release a detent and thereby permit the operation of such motor and the revolution by it, of a cam bearing upon such arm until such arm is replaced thereby in its normal position in combination with an electric magnet in a closed circuit, provided with an armature to be attracted by an adapted abnormal current, and by such attraction to release such arm.